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The Transportation of Refrigerated Meat to Panama*

BY ROLAND ALLWORK, MEMBER.

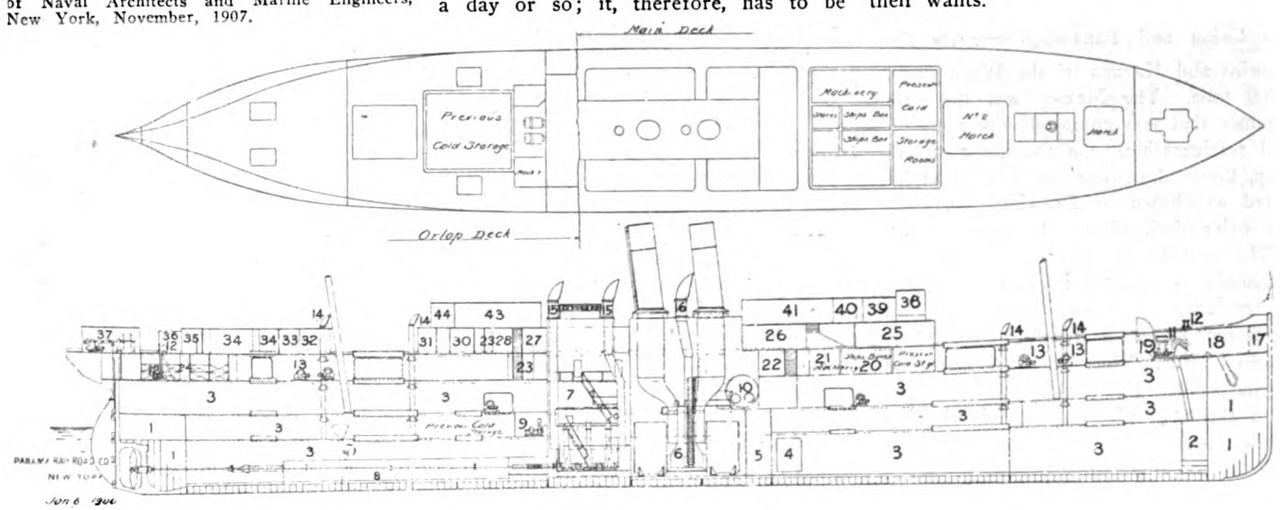
In complying with the request of some of the members of this society to contribute a paper on refrigeration in steamships, I would preface this paper with the statement that my experience with refrigeration in this direction has been limited to only four steamers that have been equipped with mechanical refrigeration, and and even if time would permit me to do so, I am afraid a scientific discussion on this subject would fall short of the expectations of members who have made the subject of refrigeration a more complete study than the author has.

This paper is, therefore, intended only to give a description of what has been done in the way of transportation of refrigerated meats to Panama, for the use of the thousands of men and their families who are located on the isthmus to build the greatest of all artificial waterways known as "The Panama Canal."

It is generally known that in tropical climates beef will not keep more than a day or so; it, therefore, has to be eaten the same day that it is killed. There is, therefore, a very urgent need for cold storage facilities on the isthmus.

In September, 1905, I was appointed inspecting engineer for machinery and materials which were being sent to the isthmus to build the canal, and in the latter part of that year I was called to Washington by the late chairman of the Isthmian Canal Commission to discuss the plans for the erection of a cold storage building at the isthmus, with enough refrigerated storage to supply their wants.

*Paper read at annual meeting of Society of Naval Architects and Marine Engineers, New York, November, 1907.



1—Trimming tank (magazine)
2—Chain locker
3—Cargo space
4—Fresh water tanks
5—Coal bunker
6—Boiler room
7—Engine room
8—Shaft alley
9—Dynamo room
10—Donkey boiler
11—Steam windlass
12—Steam capstan
13—Steam winches
14—Ventilators
15—Ventilators engine room
16—Ventilators fire room
17—Stores
18—Crew space
19—Hatch to crew space
20—Ice house
21—Stores
22—Galley first class passengers
23—Baggage room
24—Steerage passengers
25—First class dining saloon
26—First class pantry
27—Specie room
28—Stewardesses
29—Linen locker
30—First class lavatories
31—First class bath room
32—Second class dining saloon
33—Second class pantry
34—Second class staterooms
35—Second class lavatories
36—Steerage companion
37—Steering engine
38—Pilot house
39—Captain's cabin
40—Officers' cabin
41—Social hall
42—Wash room
43—To smoking room
44—First class stateroom

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Plans and specifications were made for a reinforced concrete building with 50,000 cu. ft. of refrigerated storage. In this I was advised and assisted by H. C. Gardner, chief engineer for Messrs. Swift & Co., Mr. Smith, chief engineer for Messrs. Armour & Co., and F. N. Friedmann, consulting refrigerating engineer of this city.

The next step was to equip the steamers of the Panama Railroad Steamship line with cold storage.

As superintending engineer of that steamship company, I had to take his task, and it is my purpose in this paper to give a description of these refrigerating plants.

We had at that time five steamers in service on this line:

The Advance and Finance, steamers of 2,600 tons; the Allianca, 3,000 tons; and the Colon and Panama (formerly the Mexico and Havana of the Ward line), 5,600 tons. The Mexico was the only steamer that was equipped with mechanical refrigeration. On the latter steamship, the cold storage for cargo was located as shown in Drawing No. 1 in the orlop deck aft of the engine room.

The system of refrigeration was the ammonia compression system. The compressor, condenser, brine tank and brine pump were located in a small room marked "Machy" leading out of the main engine room. The plant is what is rated as a three-ton plant. It consisted of a duplex compressor, 4 in. by 9 in., operated by a single engine 7-in. diameter, cylinder 7-in. stroke, an enclosed condenser, and enclosed brine tank.

For those members who are not conversant with the process of refrigeration it may be well to give a short description of the different stages that have to be gone through to eventually put cold brine in the brine pipes which encircle the cold storage rooms.

In commercial refrigerating or ice machines there are four principal refrigerants used—ammonia, carbonic gas, sulphurous acid, and air.

I will not go into the relative merits of these refrigerants, but ammonia was chosen because it is most generally used by packing houses, and we did not wish to deviate from the well-trodden path.

Of the several ammonia systems in use, the ammonia compression system with cold-brine circulation is the best suited for ship refrigeration, and this system was, therefore, installed on our boats.

This system consists of the following parts:

1. Ammonia compressor.
2. Ammonia condenser.
3. Ammonia receiver.
4. Brine cooling tank.
5. Brine circulating pump.
6. Brine cooling coils, in cold storage rooms.

The process of refrigeration is as follows:

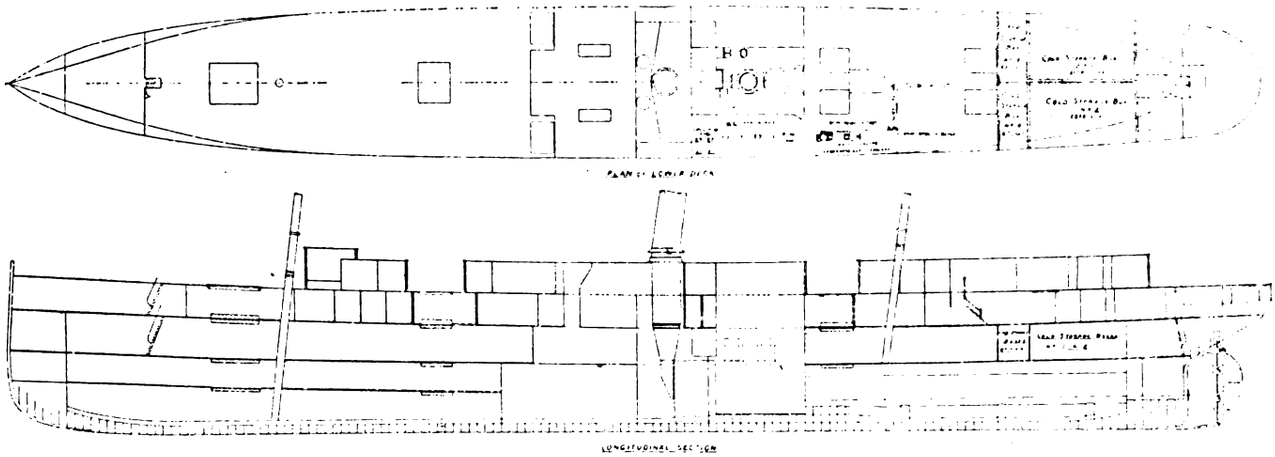
The liquid anhydrous ammonia is allowed to expand from the ammonia receiver into the coils of the brine cooling tank. In expanding from a liquid into a gaseous state in these coils, the ammonia cools the brine surrounding the coils to a low temperature. From the coils in the brine cooling tank the ammonia gas is drawn into the compressor where it is compressed and forced through the ammonia condenser, in which the hot, dense gas from the compressor is cooled off to the temperature of the cooling water and returned again to the receiver in its liquid state, ready to be again expanded into the brine cooling coils, thus repeating its circulation over and over again.

The cooling water in the condenser takes away from the ammonia the heat which it has acquired during compression, and also absorbs the heat transferred to the ammonia while producing refrigeration in the brine cooling coils.

The brine part of the plant operates as follows:

The body of brine contained in the brine tank is cooled by the ammonia coils in the tank. This cold brine is taken from the bottom of the brine tank, and by means of a pump is circulated through the cooling coils in the cold storage room, and then again discharged into the top of the brine tank. The temperature of the brine leaving the coils will be several degrees higher than the initial temperature of the brine, but in the brine cooling tank the brine is again lowered to its initial temperature.

Salt or chloride of calcium can be used for the brine, but the latter is preferable on account of its lower freezing point and its non-corrosive action on the pipes.



COLD STORAGE PLANT ON STEAMERS ADVANCE AND FINANCE.

In place of the brine cooling tank and the submerged condenser used on the steamers Colon (Mexico), Panama (Havana), we have installed on the steamers Advance and Finance a double-pipe brine cooler and double-pipe condenser, as they possess some advantages over the former, which we herewith set forth.

In the brine cooler plants, the brine is pumped through the cooler, where it is cooled by the ammonia, and from there it passes through the cooling coils in the cold storage room and is then discharged into a brine return tank. From the brine return tank the pump takes the brine and again passes it through the brine cooler and coils, repeating the above operations over and over again.

The brine coolers used on the Advance and Finance are of the double-pipe, or

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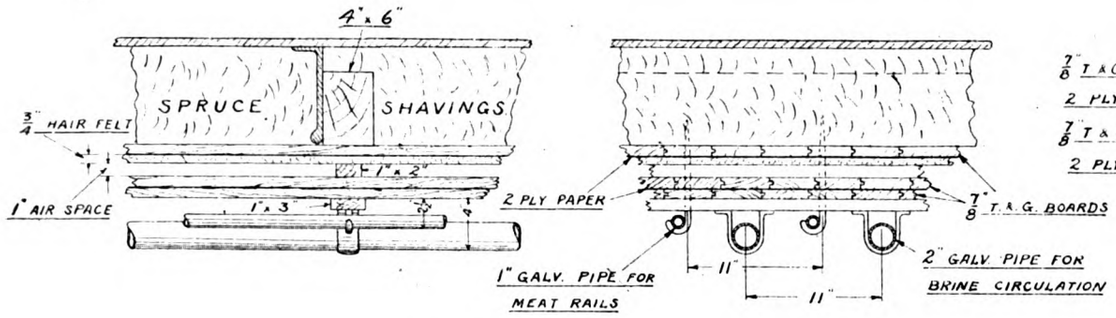
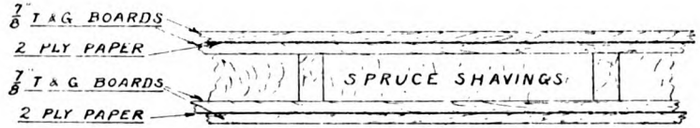
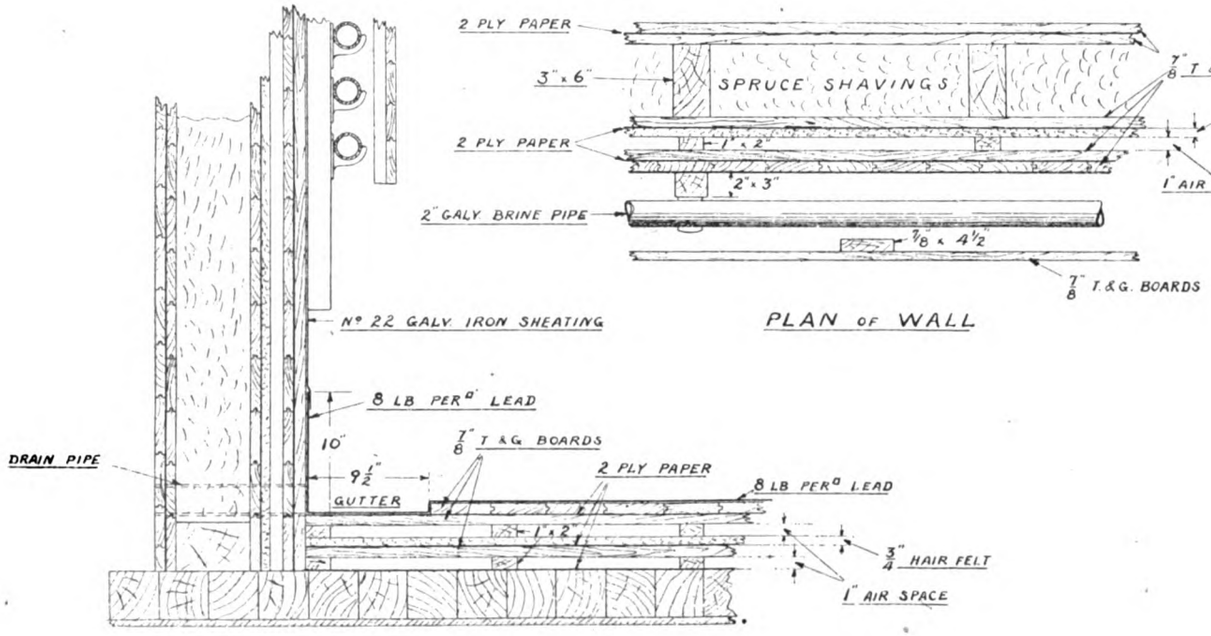


DETAIL OF CEILING

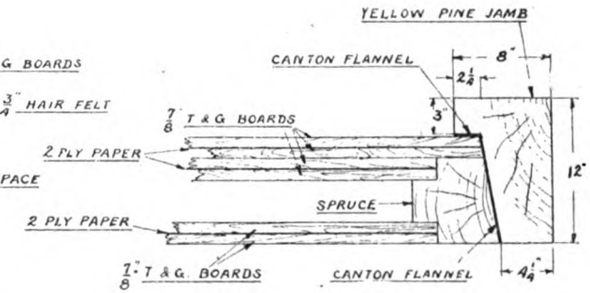


DETAIL OF PARTITION



PLAN OF WALL

ELEVATION DETAIL OF WALL AND FLOOR



DETAIL OF DOOR

DETAILS OF INSULATION OF COLD STORAGE ROOMS OF STEAMERS COLON AND PANAMA.

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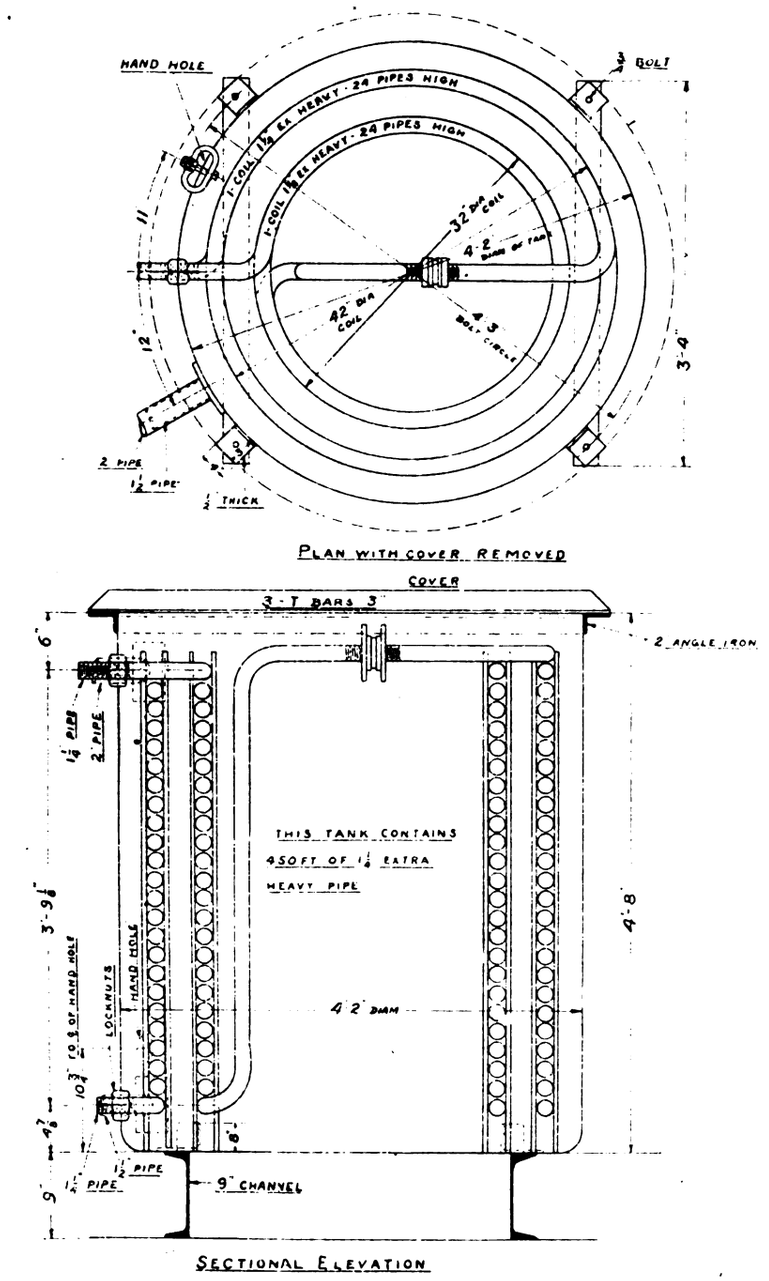
pipe within a pipe type each consisting of one coil of 3-in. and 2-in. ammonia pipe, 6 pipe high and 18 ft. long. Each cooler contains in all 108 lineal ft. of 2-in. pipe = 67 sq. ft. of cooling surface.



CONDENSER TANK FOR STEAMER COLON.

The refrigerating capacity of each cooler is eight tons.

The 2-in. pipe is placed within the 3-in. pipe, the ammonia expanding in the annular space between the two pipes and the brine circulating through the inner 2-in. pipe. This type of brine cooler is very effective, takes up comparatively little room, is easily repaired, and always accessible for inspection.

Another type of brine cooler much used is the shell cooler, consisting of a strong wrought iron or cast iron shell with a number of spiral coils placed inside the shell. The ends of the coils pass through the top and bottom heads of the shell, and are connected to headers. The ammonia is expanded into the lower part of the shell, and the compressor takes the ammonia gas from the top of the shell; the brine enters the spiral coils at the top and passes out at the bottom. This type of cooler has some points of advantage over the double-pipe type. The ammonia gas in the shell completely envelopes the brine coils and remains a long time in contact with the same, and as the shell area is very large, compared with the small annular ammonia space in the double-pipe cooler, the gas meets with much less frictional resistance.

The shell cooler also takes up less floor space than the double-pipe cooler, but it requires more head room, is less accessible for repairs and inspection, and the first cost is more than the double-pipe type.

The brine system equipped with the system of the above-mentioned brine coolers, while practically having all the advantages of the direct expansion system, has none of the disadvantages of the latter system. It will produce refrigerating results almost as quickly as the direct expansion; it is more safe, as all the ammonia parts are confined in one place, and no ammonia is circulated in the cold storage rooms. It is more simple to operate and to control, and a more even temperature can be maintained in the rooms.

In case of stoppage of the compressor, there is always a supply of cold brine on hand in the brine cooling tank or brine return tank to run the plant for some time. This is not possible with a direct expansion plant and the refrigeration ceases immediately when the machine stops.

The brine return tanks on the Advance and Finance have a sufficient storage capacity to maintain a temperature in the rooms, with a very little loss, for about four or five hours, should the machine have to be stopped for any reason.

The condensers on these ships are also of the double-pipe type of precisely the same construction as the cooler before described. Each condenser consists of one coil of 2-in. and 1¼-in. pipe, 6 pipe high × 19 ft. long. The total number of lineal feet of 1¼-in. pipe in the condenser is 114 ft.—50 sq. ft. of cooling surface. Condensers are each of 7½-ton refrigerating capacity.

The ammonia gas passes through the annular space between the 2-in. and 1¼-in. pipe, and the circulating sea water is passed through the 1¼-in. inner pipe in the opposite direction to the ammonia, thus producing a counter-current effect which cools the ammonia gas in the most effectual manner, keeps it in intimate contact with the cooling surface, and discharges the cooling water within a few degrees of the temperature of the gas. This type of condenser will, therefore, use less water and requires considerable less cooling surface than any other type of condenser.

The only objection to this type of condenser is that sea water in time fouls the pipes, and we find it somewhat troublesome to clean these pipes, but I understand that in later types of double-

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pipe condenser the aforesaid objection has been overcome, and the water pipes can now be easily and quickly cleaned without disturbing any ammonia joint.

One of the drawings, No. 7, submitted with this paper shows the construction of the double-pipe condenser. The brine cooler is constructed in the same manner, only using larger pipes. I also show in one of the drawings attached with this paper a plan of an enclosed sub-

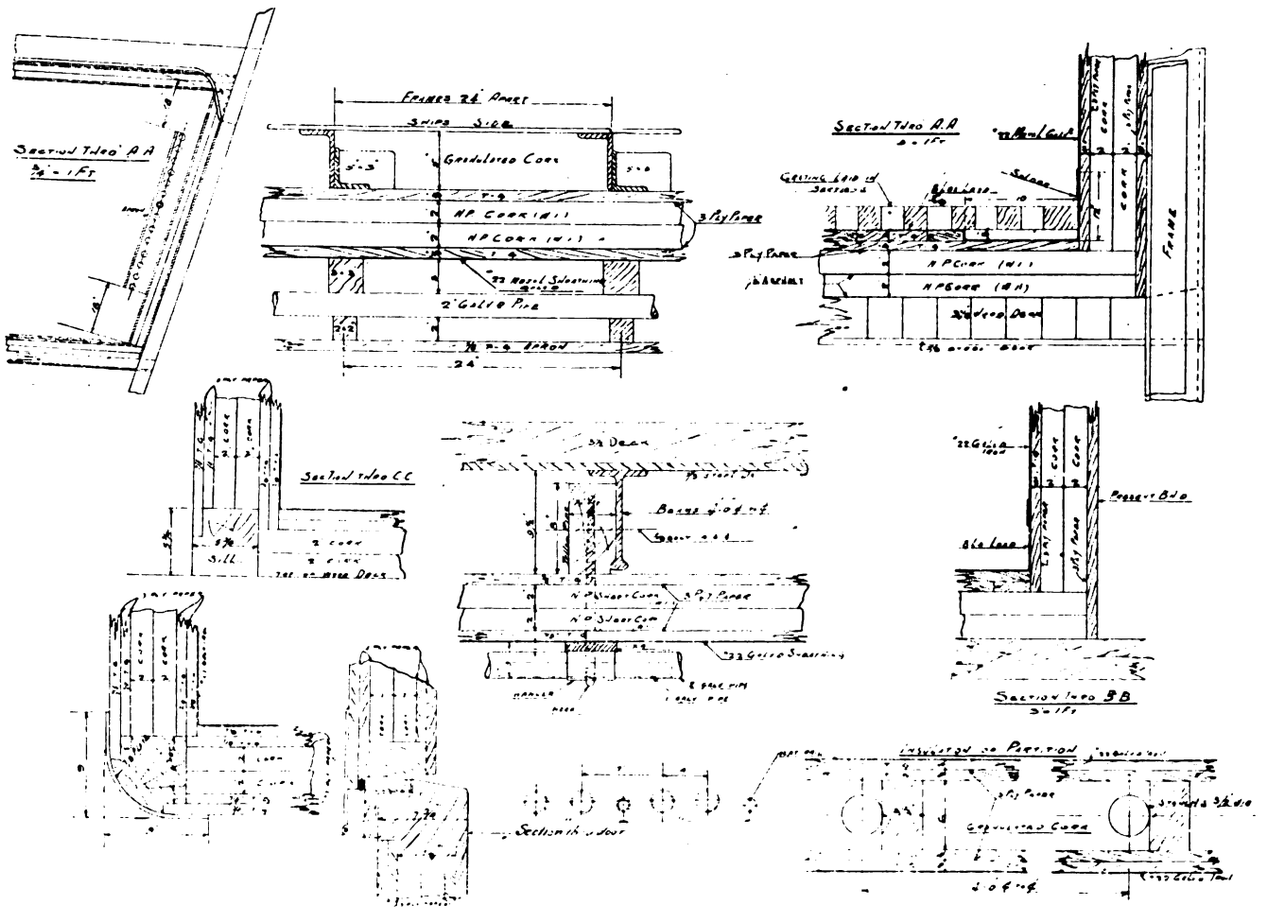
in the same way, except that it was larger and had three coils instead of two—dimensions being 5 ft. diameter, 5 ft. 8 in. high, 900 lineal ft. of 1¼-in. pipe coils in this tank, the ammonia expands through the coils, cooling the brine in the tank surrounding the coils.

There was one cold storage room with the brine coils on the walls and ceiling.

The first plan was used by the Ward line to carry meat to Cuba, and had from

cold storage rooms, with an aggregate capacity of 3,000 cu. ft. (the same capacity as the one room in the Mexico), and orders were given to proceed with the work on this basis. The advantages of this location were found to be two-fold.

In the first place, it enabled the delivery of meats and vegetables immediately upon the ship's arrival in port, without waiting for the cargo out of the hold to be discharged first, and in the



DETAILS OF INSULATION FOR COLD STORAGE ROOMS, STEAMERS ADVANCE AND FINANCE.

marged condenser used on the Mexico and Havana, which explains itself. Drawing No. 2.

The condenser on the refrigerating plant of the Mexico was larger on account of it being a larger plant, but this shows the type used, and this also applies to the cooling tanks, which are constructed in the same way, but which are larger.

The condenser (shown by Fig. No. 2), consists of a cylindrical shell of steel plate, 4 ft. 2 in. diameter, and 4 ft. 8 in. high, with two coils of 1¼-in. diameter extra heavy pipe, the total lineal feet of coil being 450.

The ammonia is pumped through the coils, and the water circulates in the tank on the outside of the coils.

The brine cooling tank was constructed

the information received given every satisfaction. For the purpose of the Panama service it had also some defects, the principal ones of which were the location of the cold storage room, which was, as before stated, away down in the hold, and the fact that the room was not subdivided, thereby prohibiting carrying more than one temperature for all commodities.

The S. S. Havana was at this time undergoing repairs in New York, and instructions were given to equip this steamer with mechanical refrigeration of the same capacity as the Mexico. The most convenient location for the cold storage on this ship (which was a sister ship to the Mexico), was found to be on the main deck aft of No. 2 hatch; there was just room enough to erect two

second place it easily enabled us to pipe the ship meat boxes, which were located directly aft of these rooms, and which were formerly cooled with ice.

The ship's boxes were originally designed only large enough for the run from New York to Havana, and were not of sufficient capacity for a run from New York to Colon, approximately twice the distance. By using brine pipes instead of ice it increased the capacity of the ship's boxes. The brine pipes used were 2-in. galvanized pipes, and the ratio of cubic feet of refrigerated space to lineal feet of 2-in. pipe was 2.6 to 1 or 4.4 cu. ft. of refrigerated space to 1 sq. ft. of cooling surface.

The machinery was an exact duplicate of that in the Mexico, but instead of being located in the engine room as in

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the Mexico, it was located on the port side aft of the refrigerated rooms.

The advantage of this location was found to be so apparant that new cold storage rooms were afterwards built on the Mexico, similar to those on the Havana.

A five-ton plant was, however, put on the Mexico instead of a three-ton plant, as it was found that the three-ton plant was operated nearly to its limit.

The machinery was of the same type.

The insulation of the cold storage rooms consisted of matched spruce boarding, with the inner space packed with spruce shavings, as shown on Drawing No. 3. Spruce was used as it gives no odor, and the shavings do not "pack" or shake down like sawdust, as their elasticity keeps them in place.

The shavings were short and were made by an ordinary rotary planer, and I consider it, when cost is taken into consideration, the most efficient insulation that can be adopted.

There is one disadvanage, however. It requires a thicker wall (over twice the thickness) than cork insulation of the same efficiency, and great care must be taken to prevent moisture getting into the insulation as this will quickly destroy its insulating qualities. It is, however, more economical in the first cost than cork blocks.

The cargo refrigerating rooms consisted of two rooms, each of the same dimensions and similarly piped with 2-in. galvanized iron brine coils.

Drawing No. 4 shows arrangement of machinery and refrigerated rooms in these ships.

Below are two copies of the daily logs of the Mexico and Havana which present an average record of each ship.

It will be seen that one room was kept at a temperature of 28 degrees Fahr., and the other at 40 degrees Fahr., the reason being that the former was used for meat, and the latter for fruits and vegetables.

The brine pipes were in two groups in each box, that is, with a separate supply and return for each, one group was on the ceiling and the other on the walls.

The rooms were piped the same, so that, should occasion require it, either or both boxes could be used for the meat.

Drawing No. 3 also shows the arrangement of hanging the brine pipes and meat rails. The meat rails are 11 in. center to center and are of 1-in. galvanized pipe. They are supported by long screwed hooks, screwed into 6-in. by 4-in. yellow pine timbers which are bolted to the deck beams. The meat is carried on galvanized hooks, which are hung on the meat rails.

The brine pipes are supported by galvanized iron clips on the ceiling and by pipe brackets on the walls.

The floor is covered with eight pounds per square foot of sheet lead, the planking forming the floor being doubled in the center in order to form a depression or gutterway 10 in. wide all around the edge, the gutter draining out through a pipe at the side of the house, which drain was plugged outside when the water had been drained off.

In the fruit and vegetable room it was found that some of the fruit and vegetables during one voyage showed signs of getting bad.

This was due to moisture and was remedied by putting two 12-in. electric fans in galvanized chutes or casings, so as to deliver a current of air around the brine coils, and between the walls and apron, the purpose being to condense the moisture in the air over the coils and carry it away in the gutter. After this means was adopted there was no trouble with bad fruit or vegetables.

But I have come to the conclusion that if the fruit and vegetables are received in a not over-ripe condition and if the door of the refrigerated room is not opened too often on the voyage that there would be no need of a fan, as they have been so carried without injury on the Advance and Finance.

The need for good wholesome meat on the isthmus was so urgent that it was necessary to carry it on the next incoming ship.

The necessary machinery and material was purchased and in five days after the ship's arrival one of the rooms was built, piped, and meat stowed. Although so short a time was taken the only part of the work that was omitted was the galvanized iron lining, which was put upon the ship's return to port. The brine pipes in this room, of course, had to come down to do this.

Instead of 3,000 cu. ft. capacity (as on the Mexico and Havana) it was decided to put in much larger capacity on the Advance and Finance. The capacity on these ships was made 5,400 cu. ft.

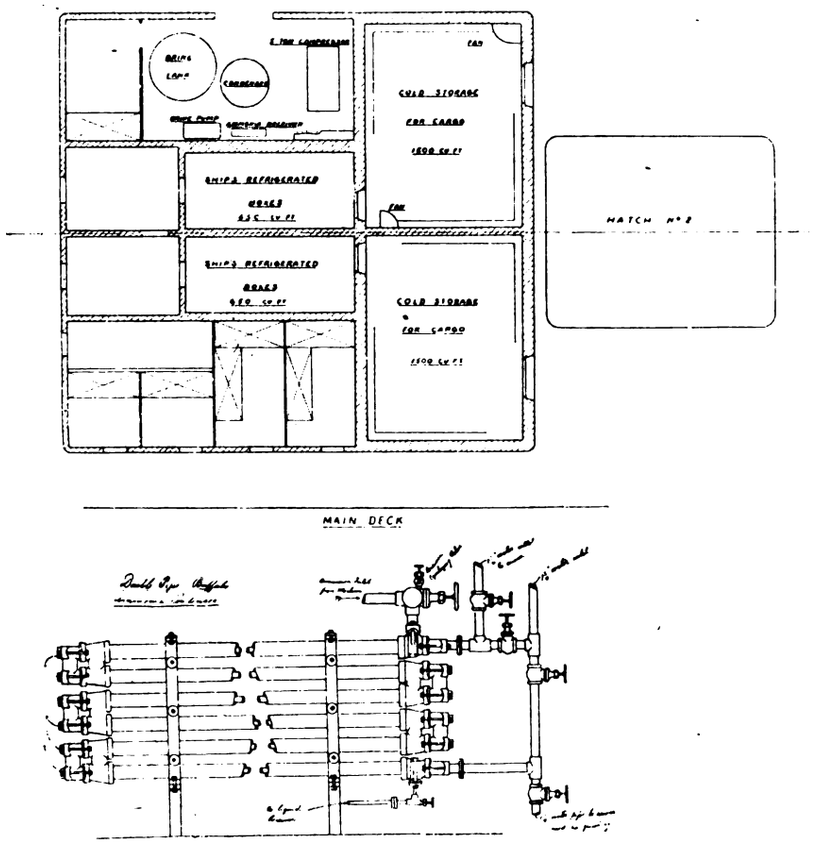
The only available space on these ships was in the upper between decks aft as shown in Drawing No. 5.

The meat chambers (of which there are two) were aft and the fruit and vegetable chambers forward, forming vestibules to the meat chambers.

The brine pipes were in three groups in the meat boxes and two groups in the vegetable boxes.

They consisted of 2-in. galvanized iron pipes with galvanized return bends.

The construction of the ceiling, walls



COLD STORAGE PLANT ON STEAMER COLON.

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and floor are as shown on Drawing No. 6.

On account of the outside walls coming against the ship's side it was considered advisable to use cork insulation and in order to simplify construction, cork was then decided on, for all walls, ceiling and floor.

The ship's side was wire-brushed clean, and two coats of white lead and zinc were put on and cork dust thrown on it while it was wet.

A layer of granulated cork was then put in the spaces between the frames.

I will not burden you with the specifications for the construction of these rooms; they consisted of carpenter work, metal, lining, piping and painting.

There was nothing of a special character in them. I think the drawings show all that is of interest.

In these chambers, the floor was covered with lead similar to that in the Mexico and Havana with a gutter all around, but this deck being below the water line the drains were carried into the bilges.

In considering the most important points in the construction of the rooms, I would say that it is important to get the joiner work carefully done, also the cork sheets (which are 2 in. thick), cut square and properly butted; in fact everything to prevent the circulation of air or the admission of moisture.

The galvanized iron lining should be 24 gage, lock seamed; in these cases it was also soldered, but I do not think that it added to its efficiency.

The pipe hangers should be wrought or malleable iron galvanized, but I do not know if it is necessary to use galvanized pipe for brine coils, as the life of the pipe is limited to the life of the threads, and the threads in galvanized pipe do not last longer than the threads in black pipe.

I would, however, recommend that if black pipe is used that it be cleaned and given a thin coat of graphite to protect it.

The meat rails should be galvanized whether pipe or bars are used.

The rooms in the Mexico and Havana were not at first lined with galvanized iron, but the sheathing was shellacked. The meat chambers, however, have since been lined on the walls as it is found easier to keep clean.

In the Mexico and Havana the cold storage rooms being on the main deck with plenty of light and air are not hard to keep clean and in good order, even though the walls are of spruce sheathing.

In the Advance and Finance the rooms being below decks it was considered advisable to line them as before stated with galvanized iron, so that a hose can be played on the walls and ceiling when the meat had been discharged and the grating taken up and scrubbed.

The machinery on the Advance and Finance, which are identical, consist of two 7½-ton refrigerating machines, each having a 6-in. diameter x 12-in. stroke double-acting ammonia compressor, and a 9-in. x 12-in. steam engine.

Two double-pipe ammonia condensers, each of 7½ ton refrigerating capacity.

Two double-pipe brine coolers, each of 8-ton capacity.

One brine return tank.

Only one compressor, one condenser, and the brine cooler is used, the other being held in reserve in case of accident.

There are two brine pumps, and two circulating pumps for the condensers, one of each is used only, the other being held in reserve in case of accident.

The size of each brine pump—6 in. x 4 in. x 6 in.

The size of each circulating pump—6 in. x 5¾ in. x 6 in.

The ratio of cubic feet capacity to lineal feet of 2-in. pipe in the cold storage room was 1.58 to one in the meat chambers, and in the fruit and vegetable chambers, about the same.

It was considered advisable to cover all the walls and ceiling with brine coils and not to be governed too much by ratios, so as to get an even distribution of cold and to regulate the temperature in the chambers by the amount of flow of brine through the coils.

The temperature of the boxes was taken every six hours, and the temperature of the brine taken every two hours as shown on the log.

The supply and return brine was taken at the manifold in the engine room, there being a separate thermometer for every return group of brine pipe to all the chambers.

The temperatures of the rooms were taken through deck fittings above the room, through the deck, the thermometer having to be withdrawn to take the readings. These thermometers were in a brass case especially constructed for the purpose. The chambers were lighted by electric light.

I think that this covers all that I can say with regard to these refrigerating plants.

It may be added that we have been fortunate enough never to have had a breakdown and the provisions have arrived at the isthmus in good condition.

There are two refrigerating engineers carried on each steamer, and they stand six-hour watches.

These ships, however, carry barely enough for the immediate needs of the isthmus; it will, therefore, be necessary to carry periodically larger quantities, in regular refrigerated steamships, so as to stock the cold storage building at Colon, our steamers being capable of keeping up the stock probably for three or four months.

AVERAGE LOG OF REFRIGERATING PLANTS.
PANAMA RAILROAD COMPANY'S STEAMSHIPS.
Plants of S. S. Colon, S. S. Panama, S. S. Advance, S. S. Finance.

	Temperatures.					Pressures.				—Speed per minute—		
		Brine.		Water.		Steam. Pressures.		Ammonia. Pressures.		Compressor.	Brine pump.	Circulating pump.
	Engine-room.	Incoming.	Outgoing.	Inlet	Outlet	Steam per sq. inch.	Vacuum, inches.	Suction.	Condenser.			
S. S. Colon—												
New York	96	..	9	72	76	70	18	20	165	103	30	35
Gulf Stream	101	..	9	83	87	70	25	20	190	110	35	40
Colon	100	..	7	84	88	70	15	20	195	103	30	35
S. S. Panama—												
New York	115	18	20	70	76	80	..	15	190	130	25	40
Gulf Stream	116	10	12	84	88	80	..	15	235	155	20	40
Colon	116	8	11	84	86	80	..	15	230	160	20	40
S. S. Advance—												
New York	102	8	15	62	70	100	25	16	148	80	26	28
Gulf Stream	112	8	12	78	74	100	25	16	178	64	26	30
Colon	110	8	12	82	90	100	25	16	185	64	26	30
S. S. Finance—												
New York	104	12	10	74	77	98	23	15	155	56	46	46
Gulf Stream	112	11	9	80	83	100	23	15	172	57	40	45
Colon	109	10	9	82	85	100	23	15	180	57	40	40

TEMPERATURE OF BOXES.

	No. 1.	No. 2.	No. 3.	No. 4.
S. S. Colon—				
New York	28	28	30	27
Gulf Stream	26	26	30	28
Colon	26	26	30	28
S. S. Panama—				
New York	30	30	30	38
Gulf Stream	26	26	28	30
Colon	26	26	28	30
S. S. Advance—				
New York	26	26	38	38
Gulf Stream	26	26	38	38
Colon	26	26	40	40
S. S. Finance—				
New York	25	25	40	40
Gulf Stream	25	25	40	40
Colon	25	25	40	40

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MECHANISM FOR OPERATING HATCH COVERS.

The accompanying drawings illustrate a simple and efficient apparatus for operating the hatch covers of a vessel to either close or open the hatch, the mechanism being adapted for operation by a suitable engine or motor.

Fig 1 is a plan of a portion of the deck of a vessel, having its hatches equipped with the hatch covers and operating mechanism. Fig. 2 is an enlarged plan of the mechanism associated with portions of two adjacent hatchways. Fig. 3 is an elevation of the mechanism taken on a plane passing athwartship. Fig. 4 is an elevation on the plane extending fore-and-aft, and looking at the end of one of the hatch coamings. Fig. 5 is a bottom perspective view of several cooperating covers. Fig. 6 is a perspective view of the hatch coaming near one end, and Fig. 7 is a perspective view of a portion of the operating shaft, showing two of the operating dogs.

The deck of the vessel is shown provided with hatchways extending athwartship, each hatchway having a coaming, shown as a channel beam with its flanges facing outwardly, the sides of which are designated 11 and the ends 12. The hatch covers, designated 13, are preferably made of

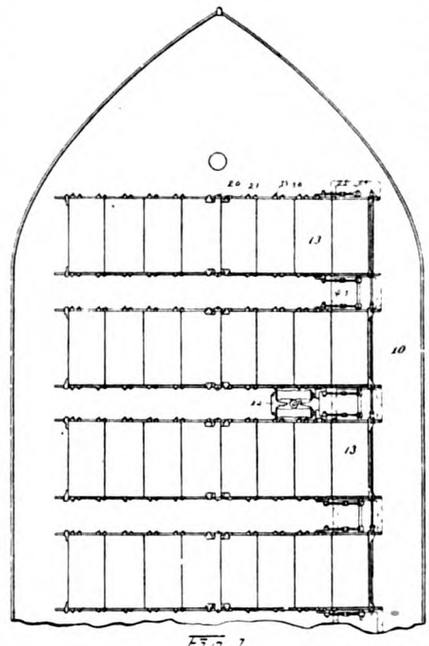

Fig. 1

sheet metal and provided with downward flanges 14 at their edges. They rest on the upper surface of the hatch coaming and overlap each other so that they may be telescoped together or drawn outwardly, and are so designed that they can be drawn from each end of the hatch toward the center. The covers on each side of the center thus overlap the covers which are nearer the gunwale on that side, the successive covers increasing in width sufficiently to allow their flanges to extend over those of the adjacent cover, as shown in Fig 5.

Reference to Fig. 5 will show that the forward edges of the covers—the fore-and-aft edge on the side toward the central plane of the vessel—have down-turned flanges 15, and that the flanges of the cover are connected with the flanges of the adjacent cover by suitable means, as pairs of links 16. The result is that when the forward cover has been moved toward the center of the ship, a distance slightly less than the width of the cover, the links become taut and continued movement of the forward covers is communicated to the next cover. The movement of this latter cover, when it has moved its proper distance, is communicated to the cover next to it, and so on. If the forward covers on each side be engaged and moved to the central plane of the vessel, as described, the

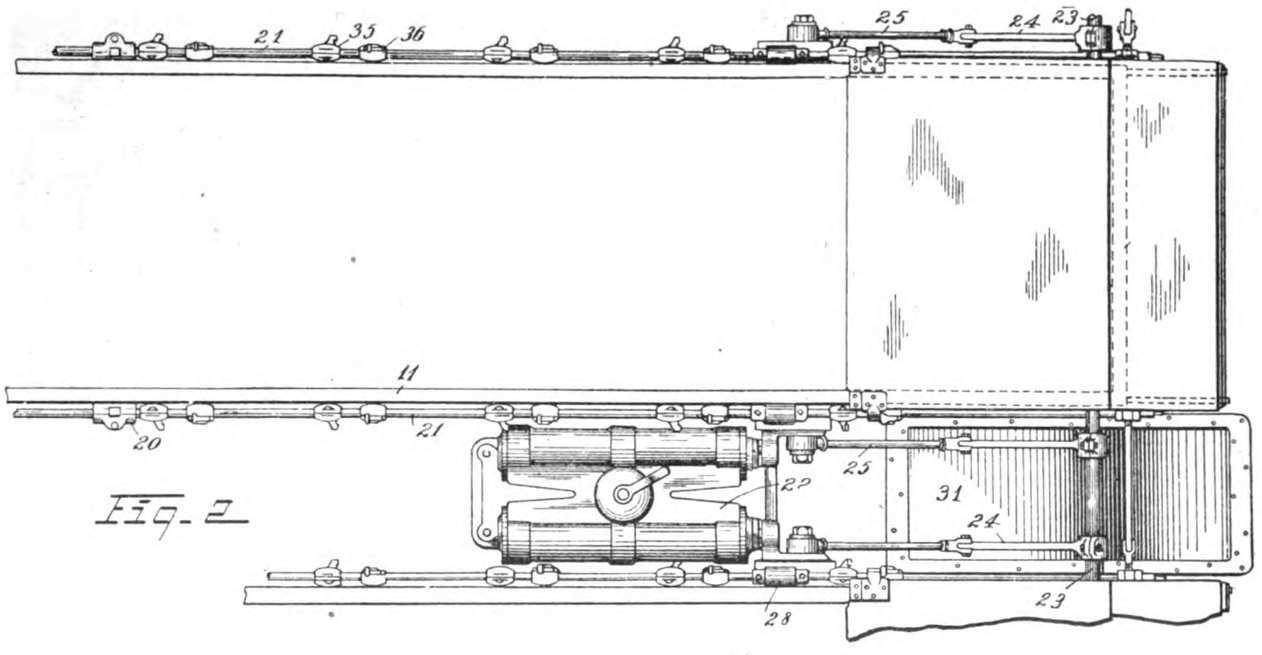

Fig. 2

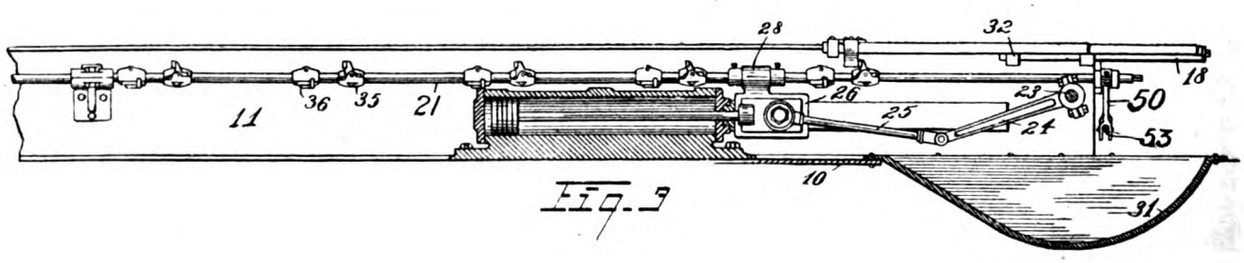

Fig. 3

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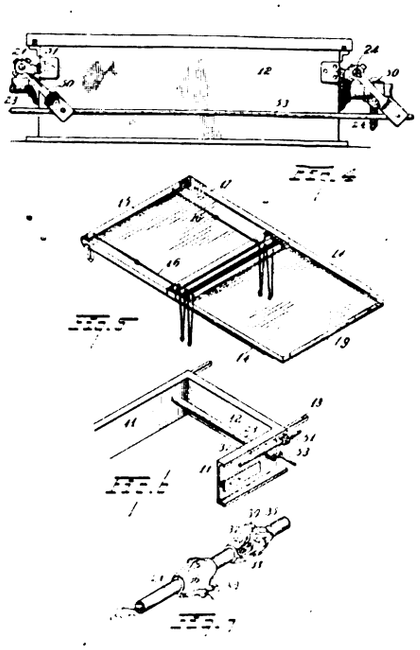
hatch will be closed. If, when the hatch is covered, these forward covers are engaged and move outwardly, the downward flange on each cover will engage the downward flange on the adjacent cover successively, thus causing the covers to telescope, one passing on top of the other, the covers thus accumulating in a pile at the extreme end of the hatch. To enable the hatch covers to be piled up at the extreme end of the hatch extension bars, 18, are provided, these bars being loosely slidable in lugs, 32, carried by the hatch coaming near its ends, and are secured at their outer ends to a downturned flange, 19, on the endmost cover. When the covers are closed this flange is drawn up against the end hatch coaming, 12. As the



covers are moved into their outermost position, the final movement carries the pile thereof beyond the coaming, this movement drawing out the slidable bars, 18, to support the covers in this position.

To cause the forward covers on the two sides to be engaged and moved toward or from the center of the vessel as above described, the following mechanism is provided. Mounted in bearings, 20, secured to the outer sides of the hatch coamings are shafts, 21, extending athwartship, these shafts being adapted for reciprocation by a suitable engine or motor. The shafts on several hatches may be operated by the same motor, one double-cylinder engine or motor, 22, being shown adapted to drive the shafts, 21, of four hatches, as follows:

Extending fore-and-aft is a rock shaft on which are mounted rock arms connected by links with cross heads which are slidably mounted on guides secured to the outer sides of the hatch coamings. Each of these cross heads have lugs connected to the corresponding shaft, the shaft, as shown, passing through the lug. Collars are provided on opposite sides of the lug. The driving engine or motor is connected to rock the shaft, 23, this being accomplished by mounting the engine between certain hatches and connecting its piston rod directly to the corresponding cross head, 26. To enable the reciprocation of the shafts to operate the covers, dogs are provided upon the shaft adapted to engage a shoulder on the forward covers. There are two series of these dogs, designated respectively 35 and 36, one series facing in the opposite direction from the other, and each series having those of its numbers which are on one side of the central plane of the vessel facing oppositely to those on the other side. Each shaft is arranged to be rocked to bring either series of dogs into active position, so that the covers may be fed in either direction.

The covers are fed towards or away from the center to open or close the hatchway by dogs 36 and 35, respectively, each dog comprising a pair of body portions—adapted to be held together around the shaft, 21, which they clamp—a pawl pivoted to the body members, and a spring acting on the pawl. Depending at the edge of each of the forward covers are lugs 17.

Assuming that the hatch is entirely open, when the movement of the shaft moves the endmost dog toward the center of the vessel, the pawl on this dog engages the lug, 17, and moves the forward hatch cover to that side forward a distance substantially equal to the distance from the rearmost dog to the next dog. As the shaft reciprocates in the opposite direction, the covers of the set just acted on retain their position and the forward cover of the other set is advanced, then at the end of such movement of the shaft, the next dog on the side first engaged co-acts with the first lug, and then forward reciprocation again advances this hatch cover. The continuation of this movement draws out all the telescoping covers until the forward covers meet at the center of the hatch, one of the forward covers having a raised edge to overlap the others at this point. It is to be understood that the dogs 35 on each side of the central fore-and-aft plane face towards that plane, and when they move away from that plane may pass idly under the lugs. The other set of dogs, 36, are similar to the dogs 35, except that the set faces in the opposite direction; that is, on each side of the central fore-and-aft plane, they face away from that plane. These dogs have their pawls projecting in a plane which may be about at right angles to the plane the pawls of the dogs occupy. Dogs 36 are thus idle when dogs 35 are acting. If the shaft, 21, is rocked about 90°, the pawls of the dogs, 36, are swung into active position, and the dogs 35 come into idle position. When this has been done the reciprocation of the shaft, 21, communicates the reverse movement of the covers—the lug, 17, being engaged on its forward side by the pawls of the dogs 36, and the successive reciprocations serving to shove backward the forward cover, and with it the other covers successively accumulating beneath it.

To rock the various shafts, 21, simultaneously, rock arms, 50, are mounted thereon, the rock arms being contained between the forks of a bearing, 51, secured to the end hatch coaming, 12. The shafts are freely slidable through these rock arms but have a tongue and groove connection therewith so that they rock together. There is a groove in the shaft and a tongue on the arm entering the same. The various rock arms are connected by a rod, 53, extending fore-and-aft, the simple shifting of which, by hand or otherwise, in one direction or the other, brings one set of dogs or the other into action so that the operation of the motor moves the cover to either open or close the hatch, as desired.

It will be seen from the above description that the pivoted pawls of the dogs and the lug on the cover constitute in effect a ratchet device adapted to communicate movement in one direction but not in the other. The two sets of pawls may be characterized as giving the mechanism a double-faced ratchet effect. When the covers on one side are being moved by the corresponding dogs, the covers on the other side are stationary, the dogs moving in the idle direction. The mechanism is thus called upon to give only half the power which would be necessary if the covers on both sides were moved simultaneously. This double-faced ratchet arrangement, with means for controlling which face is in action, is adapted for a very simple installation, and is at the same time one which is effective in service.

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The arrangement being such that the motor or engine may continue in operation after the hatch cover has been completely opened or closed, with no injury to the mechanism, close attention to the controlling of its action is dispensed with.

The inventor of this improved mechanism for opening and closing hatch covers is Tulley B. Armstrong, of Lakewood, O., who is connected with the Wintor Motor Carriage Co.

TWIN SCREW SUBMARINE BOAT

In order to secure for submarine or submergible boats of the usual substantially circular cross sectional construction the advantages of double screw propulsion, avoiding the use of outboard bracket bearings for the screw shafts, Lawrence York Spear, of Quincy, Mass., has invented certain improvements in design, the principle of which is the gradual diminishing vertically of the stern section of the boat, so as to finally merge, through gradually flattening elliptical cross sections, into a stern frame having substantially parallel sides, within which frame are formed the end bearings of the screws' shafts. Inasmuch as the departure from the substantially cross section of the hull will tend to reduce the stiffness of the stern section and impair its capacity to sustain heavy pressure due to its submergence, the invention also contemplates the provision of means for counter-balancing the external pressure of submergence, whenever necessary, so as to completely relieve the stern section from all tendency to collapse when the boat is submerged.

Fig. 1, in the accompanying drawings, is a vertical longtitudinal section through the after portion of a submarine boat, showing the application of the invention. Fig. 2 is a horizontal longtitudinal section on line 2-2 of Fig. 1. Figs. 3, 4, 5 and 6 are sections taken on lines 3-3, 4-4, 5-5 and 6-6 respectively, of Fig. 2. In the present invention the hull is maintained substantially circular in cross section, aft to such point as will admit of the gradual and fair merging of the remaining aft section into the substantially horizontal stern frame *f*, the frame being provided at its ends with enlarged bosses to form bearings for the propeller shafts. The shell plating in continued aft over stern section and terminates in the stern frame, to which it is riveted.

Formed as an integral part of the casting or forging constituting the stern frame are the middle bearings *h* for the steering rudder *i* and the driving rudders *j*. The outboard bearings of the diving rudders are formed in lateral skegs *k-k* formed of plating and secured to the shell. The steering rudder finds its outboard bearings in the bottom of skeg *w* and the superstructure *x*. The screws *s-s* are placed forward of the rudders to assist materially, by reason of the reaction of the columns of water thrown off by the screws against the rudders, in the steering and diving operations.

A watertight bulkhead is applied at a point intermediate the extremes of the stern section and before the elliptical form of the frames becomes exaggerated. The bulkhead materially assists the elliptical frames between the same and the first circular frame in stiffening the forward part of the stern section against deformation or collapse due to the pressure of submergence. The portion of the hull abaft this bulkhead is not intended to withstand heavy pressure due to submergence, although it may be amply strong to resist the pressure to which it is subjected when the vessel is operating on the surface. If it is not desired to use this space abaft the bulkhead *l*, the danger of the section collapsing under the pressure of submergence may be avoided by making the section non-watertight. This may be effected by either providing the sections with permanent openings to admit of the water entering and leaving the sections freely, or it may be effected, when desired, by valves placed at the top or bottom of the section and controlled from other portions of the boat.

As it is generally preferred to utilize the space in the stern section of the boat for the storage of fuel in the form of oil and the like, under these circumstances the counterbalancing of the pressure of submergence may be effected by means of the fittings illustrated in Fig 1, whereby the fuel may be admitted to the stern section abaft the bulkhead, the latter may be vented at the top and be opened at the bot-

Fig. 1.

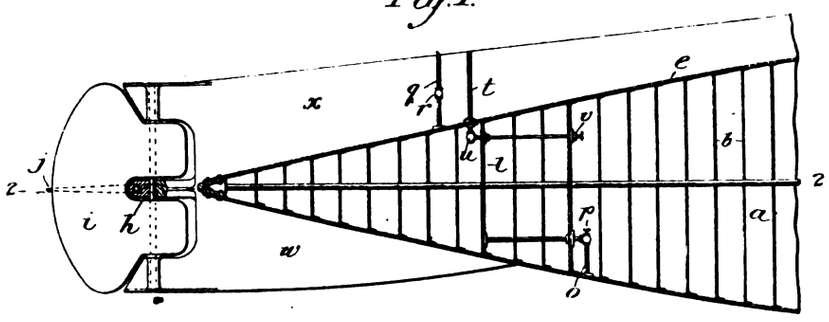


Fig. 6.

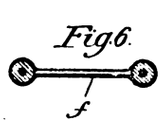


Fig. 5.

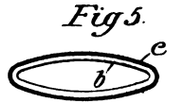


Fig. 4.

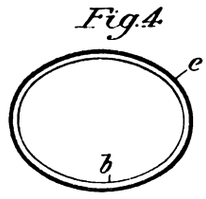


Fig. 3.

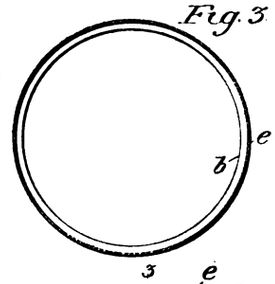
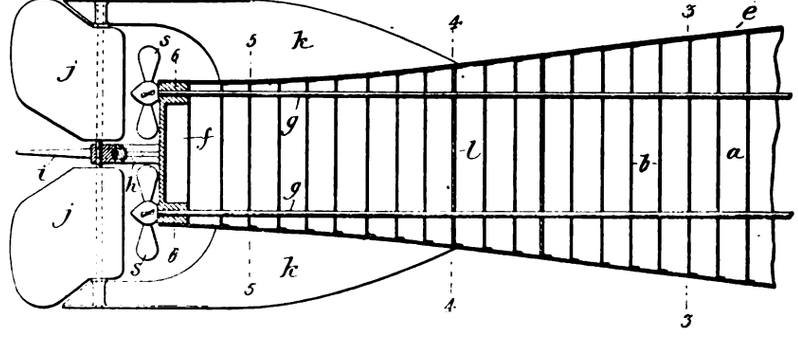


Fig. 2.



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tom to the pressure of the surrounding water.

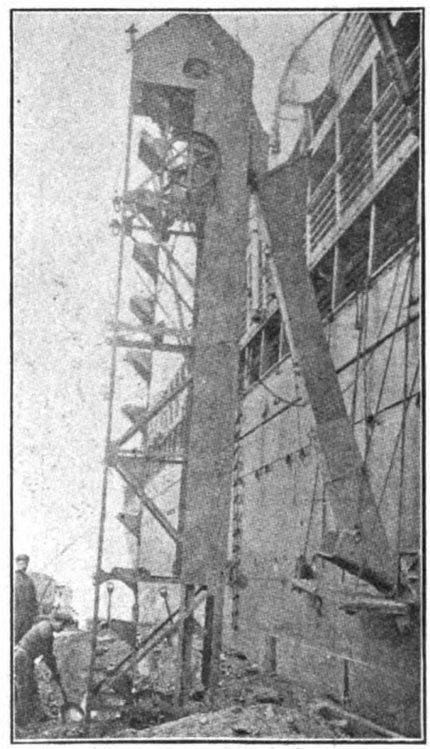
In Fig. 1 *q* represents a vent pipe, passing from the storage compartment behind the bulkhead *l*, which vent pipe is controlled by a suitable cock or valve *r*. The fuel is admitted to the compartment through a filling pipe *t* which is controlled by a valve *u* operated by a suitable handle *v* located within the interior of the boat. A pipe *o* communicates with the interior of the tank at one end and with the sea at the other, and is controlled by a valve *p* so as to admit or exclude the sea water from the interior of the stern section. Before submergence of the boat the valve *p* is opened, thereby opening communication between the stern section and the sea, and in case the space is not entirely filled with oil or other fuel, either one of the valves *r* or *u* in the pipes *q* and *t*, respectively, may be opened to vent compartment and permit it to fill. When the space is entirely filled with oil and water, the valve *r* or *u* which has been opened is closed, while the valve *p* is allowed to remain opened in order to freely admit the water of submergence and equalize the pressure on the inside and outside of the section. This not only prevents any change in the weight of the vessel when submerged, but also absolutely precludes any danger of collapse of this portion of the hull. The propeller shafts may, of course, be run trough this stern section in the usual form, in stern tubes not shown.

APPARATUS FOR COALING VESSELS.

The de Mayo Coaling Co. has recently opened offices in the West Street building, New York City, and is preparing to install its coal-handling tower wherever rapid and economical coaling of vessels is required.

As seen in the illustration, the apparatus consists of a series of buckets or scoops in endless chain form driven by a motor, the whole being mounted in a tower. The base of the tower rests in the coal on the barge, the tower itself being supported and guided by block and fall gear attached to a suitable boom or mast, and free to move within an area of 25 ft. from the point of discharge. A telescopic chute is arranged between the bucket discharge and the point of delivery and is free to move in conjunction with the tower. The driving motor is housed in the upper casing of the tower, thus permitting the operation of the tower at any angle or location.

The tower is shown open, for demonstrative purposes, but in operation is enclosed. This insures against loss of material and escape of dust. The motor is protected from injury through weather or other conditions. The de Mayo coaling towers can be arranged to operate so that the trim of the vessel is maintained while cargo is being worked. They are also suitable for handling other mineral, grain and the like, no skilled labor being necessary in their operation.



DE MAYO COALING TOWER.

MODERN CONTRIVANCES IN THE STOKEHOLD.

At the Institute of Marine Engineers a paper on "Modern Contrivances in the Stokehold" was read by J. C. Brand. In the course of his paper the author said he considered that the insertion in log books of columns for the air pressure at fan, ashpits, and furnaces would be a guide of value to chief engineers. The value of forced draft, using air at the engine room temperature, might be taken at about 4 per cent, which economy was probably due to efficient disposition of the air to the furnace. An economy of 15 per cent was claimed for systems such as Howden's, using heated air. In an endeavor to obtain a high air temperature, retarders, having three twists in their length, were introduced into the uptake heating tubes as an experiment. The retarders were hook-shaped at the end, and passed over an iron bar, 1¼ in. by ¼ in., which lay across the tube centers. Before introducing the retarders the temperature of the air in the ashpits was 220 deg., temperature of gas in the smokebox 753 deg. F., and the temperature of gas at the root of funnel was 450 deg. F., while after introducing retarders the figures were 244, 750, and 422 respectively. The author described the salient features in the Muirhead retarder rotator gear, which was designed to turn all the retarders in the tubes in one nest simultaneously, thus scraping the internal surface of the tubes, the draft carrying away the soot. If the thickness of soot in the tubes were taken as 1/16 of an inch after 14 days steaming, he estimated that a saving of 13 per cent would be effected by the use of a retarder rotator. The airtight patent smokebox doors were now coming largely to the front, and, with natural or forced draft, conduced to economical working. Another device which had given very good results was Pearson's complete combustion apparatus, by means of which the product of combustion Co was converted into combustion Co2, and a great number of thermal units regained which would otherwise have been lost up the funnel.

In opening the discussion, G. W. Newall referred to the author's statement that by the use of Pearson's ejector the Co would be converted into Co2, and questioned the advantage of effecting this result, as neither of these gases could maintain combustion. With regard to checking the temperature of the funnel, he thought a pyrometer would be a very useful instrument to be fitted with an indicator in the chief engineer's cabin. He considered the high temperature at the top of the funnel was an evidence of great waste of heat, to which attention should be given in order that improvements might be effected in that direction. J. G. Robertson remarked that in a number of ships with forced draft a pyrometer is carried, and the temperature of the funnel is taken every watch and logged. W. P. Durtnall spoke of the need of an efficient method of mechanical stoking, and M. Lang gave a description of the Pearson apparatus as he understood it from the drawing. Another method of securing more perfect combustion was described by W. Britton, consisting of

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the introduction of a 2-in. air pipe leading underneath the firebars. The honorable secretary mentioned that the Murhead retarder rotator was designed with the object of overcoming the use of steam or abnormal fan blast in clearing the tubes, and also to save opening the smokebox doors. The best results were obtained by keeping the retarders open about 1 in. short of the end of the back tube plate. The retarders were also used in the heating tubes with very good results. He emphasized the importance of the heating surfaces being thoroughly and systematically scraped, in addition to brushing down with wire brushes. W. Watson stated that in his experience he had found the Co2 recorder one of the most useful instruments in the stokehold, and, if carefully watched, would bring about a reduction of coal consumption, chiefly by introducing an element of competition among the stokers. He would like to see some particulars as to the steam consumption of the jets on Messrs. Pearson's apparatus, as he understood the nozzles had a tendency to enlarge, thus bringing about a waste of steam. He endorsed Mr. Adamson's remarks as to the necessity for thoroughly scraping the heating surfaces of the boiler. A. Robertson described a method of cleaning the tubes by means of a steam jet from a pipe fitted between the back of the combustion chamber and the back plate of the boiler, turned on to the tubes at regular intervals. With reference to the temperature of the funnel, he thought it was generally acknowledged that if it were lowered beyond a certain temperature it would reduce the efficiency by affecting the draft.

OFF-SHORE FLOATING DOCK FOR SMALL CRAFT.

With so large a number of trawlers constantly in and out of port, it will be readily understood that dry docking for cleaning, repairing, and general survey work is frequently necessary at all fishery harbors. To meet such requirements the Aberdeen harbor commissioners are about to provide another off-shore floating dock larger than the present one, namely, 180 ft. long, and having a lifting power of 600 tons, the corresponding figures for the first dock being 126 ft. and 425 tons. In this connection it may be of interest to shortly state some facts relative to the usefulness of the present dock which, like the new one, was designed by Messrs. Clark & Standfield, of London. It was opened in the year 1900, and cost $47,815. The dock has a draught of water on the keel blocks when fully submerged of 15 ft. The raising is effected by electrically driven pumps. Up to November, 1907, it had docked 2,480 vessels, or rather more than an average of six per week. Every vessel using the dock is charged $10 for pumping the water out, and in addition 8 cents per gross registered ton for the first 24 hours, or part thereof, and 4 cents per ton for each subsequent 12 hours or part thereof, a reduction, however, being made when the dock is used for sighting purposes only. Its value to the Aberdeen harbor commissioners as a source of revenue will thus be at once realized. This type of dry dock is undoubtedly the best for steam trawlers, liners, and drifters, as apart from its comparative cheapness of construction, there is less waste of time and less inconvenience than would be experienced with a graving dock ashore which has a greater water capacity, and therefore requires more pumping, and is not always accessible. A similar pontoon dock, of almost identical dimensions and capacity, has been provided by the Great Central Railway Co., at Grimsby, the one at Aberdeen, however, being the larger of the two on the keel blocks by about 3 ft.

OFF-SHORE FLOATING DOCK AT ABERDEEN.

Boston, according to a compilation just announced by Surveyor of the Port McCarthy, passed 148,271 immigrants through its gates during the year 1907, this number being the highest in the history of the port.

The six-masted schooner Edward J. Lawrence, to be launched this month for J. S. Winslow & Co., Portland, will be the largest wooden vessel afloat.

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"IN THE MERCHANT SERVICE"

The position of engine-room storekeeper aboard ship is one demanding the services of a being with the patience of Job, the temper of an angel, the hoarding qualities of a miser and the resourcefulness of a—well—of an engine-room storekeeper. Recognized "for'ard" as the natural sworn foe of the fireman and oiler—not to speak of the humble coal passer—and in the engineers' quarters as a necessary evil, or otherwise, according to his ability to please all hands, he is also considerable of a diplomat. In short, aboard ship a good storekeeper is a prized possession.

HE HADN'T EVEN MANAGED A "PIER-HEAD JUMP."

On the mail steamer Alroma a good storekeeper was badly needed. For the past six months the store had seen the trying-out of numerous aspirants for the position, but in the weighing in the balance they had all been found wanting. Something had to be done, and accordingly the matter was discussed at some length in the Second's room.

"What we need," said the Second, impressively, "is a man who understands at least the first principles of storekeeping. He will have to know enough English to keep the store books. We don't want a man who is going to waste material, but, at the same time, a man who is always causing trouble by holding back oil and the like when it is actually needed is of no use to us, either."

"That's so," responded the Third, "and we want a man who can pass out a one-ton set of chain blocks when they are sent for. Blessed if I ain't tired of pawing around in a small hill of jumbled-up chain blocks, trying to unearth something that looks like a pair. Yesterday my men brought down a set of blocks for the valve gear that could have pulled the engines out by the roots."

"He will have to understand that a storekeeper's place is in the store, too," chimed in the Fourth. "At present one half of our time is lost rounding up the present incumbent. His only fault seems to be that he is never really sober."

"He's all right when the ship is outside," quickly answered the Third, scowling at his subordinate. The present incumbent had been suggested by the Third. "How about Cassidy?" he added.

The suggestion seemed to meet with general approval; Cassidy seemed to fill the bill exactly. He had only been a matter of two trips with the Alroma, but in that time he had showed his ability to rig up gear, mix paint, dress tools, and was a good all-round man. Legend had it that he had seen better days, but that is no uncommon thing aboard ship. So the trying-out of Cassidy was settled.

As the ship was to sail in 48 hours, the storekeeper of chronic thirst was hurriedly wafted shoreward with his kit and Cassidy, of many virtues, duly installed. To the third engineer he was profuse in his thanks, as he was in his promises of attention to duty and general behavior. It may be mentioned at this point that Cassidy had on one or two occasions mysteriously disappeared for the space of about 24 hours. This he attributed to fevers contracted on "the coast," said fevers returning at odd moments and causing him to lie in a coma till they passed off. This, however, was not regarded as a serious drawback, and the Third advised Cassidy that he had better keep around his room when he felt an attack coming on, in which case he could get some attention.

As was only to be expected, the new storekeeper proved to be a prize indeed. His first day in the new position was one of pleasant surprises to the engineers. The pile of chain blocks was straightened out, the blocks being hung up in a row according to capacity. The tools were neatly stacked away in place. The stores coming aboard were stowed away where they were get-atable. The work of reformation had commenced indeed, and Cassidy was it.

It was one of the chief's customs to take a camp-chair out on deck after dinner, where he would sit and watch the traffic in the harbor as he smoked his cigar. It was generally understood, also, that at that hour the chief particularly wanted peace to ruminate, so his wants in that direction were duly respected. On the evening of Cassidy's inauguration the chief had gone on deck as usual. In a few moments he was beckoning the Fourth out on deck, scowling the while.

"What in thunder do you call that, Mr. Smith," he asked, as weird strains of unearthly music came floating up from an open port in the ship's side.

"That is an accordeon," his assistant answered, wondering at the identity of the performer.

"Get it stopped," growled the chief, as he returned to his chair. An accordeon in the engineers' quarters, the idea!

The Fourth made his way along the quarters, stopping at the storekeeper's room. Cassidy lolled back on a chair with his feet on the wash-stand. There was a far-away look in his eyes, and a seraphic smile lit up his usually homely countenance. It mattered not that the bellows of the accordeon leaked and several of the keys had long ago refused to shut off. Who cared? "You'll have to cut that out, Cassidy," said the Fourth sternly, at the same time suggesting the advisability of "dumping" the "fireman's piano" at an early moment.

On his way back to the deck he smiled sadly. "Coast fever," he muttered, "I'm mighty glad that Cassidy is no protege

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of mine." The chief had departed with his camp-chair to a more peaceful part of the deck, so the Fourth kept his own council.

Next morning at daybreak the inhabitants of the engineers' quarters were rudely awakened by the stentorian bawling of some individual on deck. Boiling with indignation the Second sprang from bed and rushed to the door of the quarters. The chief was already there, stamping up and down in his night-shirt.

"Who the devil is that, Mr. Kelly," he exploded, "who is it, sir?" He pointed to an individual who, extended far over the rail, was yelling to another individual on the deck of an incoming tug. The Second laid violent hands on the most convenient part of the offender—the stern portion of his raiment—and yanked him to the deck. "What's the meaning of this conduct, Cassidy," he asked, as he glared at the new storekeeper, "are you not ashamed of yourself?"

The back-slider leant unsteadily against the rail and his face assumed a most injured expression. "'Shamed o' what," he asked thickly, "speakin' to muh frien? —muh ol' shipmate?"

"You've been drinking, Cassidy," said the Second reprovingly, "go to bed and I'll speak to you when you sleep off that load."

Muttering something about the fever having him in its deadly grip the storekeeper wabbled off down to his room. The idol had fallen. That afternoon Cassidy with his kit stole softly ashore.

He reappeared, however, on the morning of the Alroma's sailing, hurrying along the wharf. He had his kit with him.

"Good morning, Mr. Kelly," he called ingratiatingly to the Second, who was scowling at him from the deck of the steamer, "I suppose you don't need a storekeeper."

The Second thought of Cassidy's successor, who at that moment was handing out stores with a lavish hand to the oilers, and his scowl deepened.

"Maybe you need an oiler," ventured the erring one.

Still the scowl.

"Fireman, maybe?

Scowls.

"Coalpasser?'"

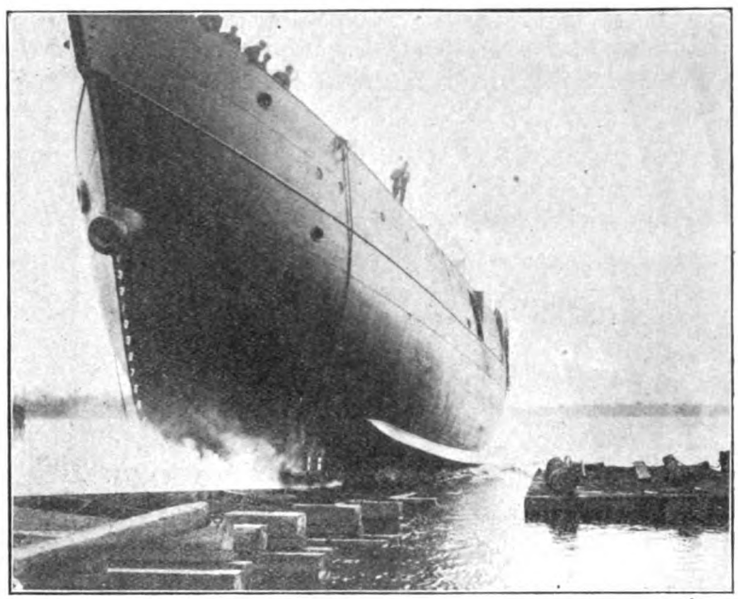
The Second turned on his heel and went below to take the ship out. When she was well down the river the solitary figure on the wharf picked up his kit and went forth to join the gang that haunts the shipping offices. He hadn't even managed a "pierhead jump." Such is life. THE "STAND-BY" MAN.

LIGHTSHIP NO. 90.

Lightship No. 90 was launched from the yard of the Fore River Ship Building Co., Quincy, Mass., on March 23, being christened by Miss Elise Johnston, of New York City, who is a student at Wellesley College. The lightship will be stationed at Hedge Fence Shoal in Vineyard Sound.

United States light vessel No. 90 is one of four similar vessels being built by the Fore River company for the lighthouse board, and is constructed of mild steel throughout to the following dimensions:

Length over all	135′ 9″
Length on load water line	113′ 0″
Breadth molded	29′ 0″
Depth of hold	15′ 4″
Displacement in salt water	600 tons.



LAUNCHING LIGHTSHIP NO. 90.

The lightship has a raking stem and elliptical stern and when completed will be rigged with two lantern masts and a jigger mast. She is of the spar deck type on which are constructed pilot house and two lantern houses. Transverse steel bulkheads divide the vessel into seven watertight compartments, the amidship ones being utilized as boiler room and engine room, the holds for the storage of fresh water tanks and the ends as trimming tanks.

On the main deck forward quarters are arranged for the berthing of the crew and aft with master and officers' staterooms. The lower deck forward and aft of machinery spaces is fitted out with storerooms and workshops. On main deck forward there has been installed a powerful steam windlass with special arrangements for anchor handling. A steam capstan has been fitted on spar deck for warping and handling the mushroom mooring anchor. Special apparatus has been provided and will be installed for hoisting the lens lanterns, fog bell and belfry, fog signal gear, etc., as usual in this class of vessel.

The ship generally has been designed, constructed and equipped for the special service intended and has been provided with everything that can possibly contribute to her efficiency for the important service to which, on completion, she will be assigned.

The propelling machinery consists of a set of compound inverted direct acting surface condensing engines with cylinders 16 in. and 31 in. in diameter with a stroke of 24 in., furnished with steam by two Scotch boilers, which in addition to supplying the main engines, will provide power for auxiliaries and heating the vessel.

The prospects of a new navy for Russia were somewhat enhanced recently when Count Uvaroff, one of the leaders of the Octoberist party, who previously had opposed any appropriation for naval construction so long as the present ministry of marine should continue, announced his conversion to the plan of rebuilding the country's navy. As a member of the budget committee of the Douma he is willing to authorize an expenditure of from $400,000,000 to $500,000,000 for the first 10 years. The ministry of marine has been asked to submit a program on this basis. The only communication which the Douma has as yet received from the general staff has been a request for an appropriation of $44,000,000 for the construction of battleships of the Dreadnought class to be stationed in the Baltic.

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FERTILITY OF RESOURCE IN THE ENGINE ROOM.

At the Institute of Marine Engineers a lecture was given by Mr. J. G. Hawthorn on "Fertility of Resource in the Engine Room." The lecturer, in opening, quoted the words of the late Mr. Macfarlane Gray, that "breakdowns at sea were providential ways of educating the marine engineer." Dealing with the question of an engine stopping suddenly, the first thing to try was to reverse the engines, and if this could be done satisfactorily, attention could be directed to the ahead gear. If the engine would not go astern the next thing was to find out if the steam were going through the pipes by opening the drain valves and giving a blow of steam right through. Starting with the high pressure engine of a triple-expansion set, various possible breakdowns were described. Assuming that part of the running gear were broken, he considered the best course to adopt would be to compound the engine, working the intermediate pressure and low pressure engines, and reducing the pressure in the valve box, as the full boiler pressure could not be carried with safety. If the intermediate connecting rod or other part were broken, he considered it advisable to transfer parts from the high pressure engine to renew the broken parts in the intermediate, so that the low pressure engine could be combined. Should it be impossible to adopt this course it would become necessary to exhaust from the high pressure round to the low pressure valve box. In connection with breakdowns in the low pressure engine, he cited a case where, as the result of the piston striking the cover, the engine was severely crippled. This was overcome by working the high pressure and intermediate pressure as compound high pressure engines, and patching up the eduction pipe so as to exhaust from the intermediate pressure into the condenser. The circulating pump was independent of the main engines, and was thus kept going, and a 4-inch hole was cut in the bottom of the condenser to let the water from a donkey pump into the boiler. It was very advisable to have a separate circulating pump, and the speed should be sacrificed to getting fresh water into the boilers. Sudden stoppages were sometimes caused through the engine overrunning her eccentrics. If the cover of the low pressure cylinder happened to get broken, he suggested that the low pressure be tried as an atmospheric engine, by blocking up the top steam port and putting back the eccentric. Faults in the condenser, he said, were readily diagnosed. The rise or fall of the temperature of the discharge would indicate where to look for the defects. The efficiency of the air pump valves were then contrasted, and in connection with this the lecturer remarked that there should always be a good fall of water from the condenser into the air pump. He then gave descriptions of some notable breakdowns, and, among others, instanced the great breakdown to the City of Paris in 1893. He afterwards dealt with breakdowns in the shafting, and showed that with a scarph break it would be enabled to turn and transmit its torsion by clips made to go round the fracture. He described a repair in a short length of tunnel shafting, where the engineers first removed the bearing to the forward side of the coupling of the broken length, chipping and filing a journal on the shaft, and packing it up with blocks of wood. They then removed four of the eight coupling bolts from each end of the broken shaft and passed a steel towing hawser five times fore and aft through the holes in order to transmit the torsion, and eventually got the shaft up solid between the couplings.

In opening the discussion which followed, Mr. J. H. Redman agreed that the condenser should be fitted as high as possible, and said he had seen one 10 to 12 feet above the level of the bottom of the air pump, thus giving a good fall for the condensed water to the pump. To illustrate the differences of opinion as to the necessary number of thrust collars, he mentioned the case of two ships of similar dimensions with 15-in. shafts, there being four collars on the one and 16 on the other.

Mr. S. Anderson gave an instance where compounding had been tried in order to reduce the speed, but had resulted in a better speed being obtained proportional to the consumption.

A gentleman present explained that the very slow speed in cable ships was obtained by reducing the pressure in the high pressure cylinder to as low as 12, working at these speeds by means of a small central valve in the stop valve. He also gave an experience with the broken cover of an intermediate cylinder, and Mr. F. M. Timpson related difficulties experienced with the choking of bilge pumps, speaking also of the greater efficiency obtained for slow speeds by linking up and reducing the pressure.

Mr. Hawthorn commented on the various points raised, and gave further instances illustrating his subject.

BOOKS.

BY JAMES ROSSAN.

Winter had settled down in earnest over the northwestern lakes, completely blocking every channel and harbor. The big steamers lay idly moored at their wharfs with funnels covered and decks and hatches hidden 'neath a coating of ice and snow.

Nature had stopped active steamboating, but passively it was going on just the same. Not out on the lake or aboard the boats, but around the red hot stove in the supply store. It was here the whole gamut of the men congregated and lived over their experiences of the past. It was here the old time rivalry of the men came to the surface, the old races were run over again, the old gales were bucked once more, and the old breakdowns with their repairs were liberally discussed.

The old men held the best chairs nearest the stove by virtue of their seniority, the young men sat farther away among the bales and boxes and chilly drafts; but they came regularly just the same, as there were days when the conversation almost amounted to a liberal education.

The storekeeper was a man with an eye for business. As trade in the steamboat suppy business lagged woefully during the dull winter months he had attempted to enliven it a bit by stocking his counters with numerous weighty volumes on the subject of marine engineering. He had called their attention to this fact on several occasions, but had received only scant encouragement.

The books and their value to the service had been liberally discussed. And old Lanigan, who was looked upon as the father of the craft, had voiced his opinion loudly in the words: "I never had no time for a book engineer, anyhow." From then on the books became a tabooed subject, undisturbed they lay on the counter, fast accumulating their coating of dust.

The storekeeper's hopes had rested in young Johnston. He had even gone so far as to advocate the forming of a club, whereby a number of them could be bought at a reduction in price. But Johnston secretly nourished the hope that old Lanigan would take him on as first assistant the coming season, consequenty he had to leave the subject of the books alone.

It was not until Jackson arrived home that the topic of the books was opened up again. Jackson had laid his boat up in a port far away and was a late comer. He knew noth-

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ing whatever of the ill-repute placed upon the books, and their presence on the counter was the first thing that struck him as unusual. He stepped over to the counter, cast a furtive eye over the lot, and then began a minute inspection of a particular volume.

"Yes," he said, as he laid it to one side, "that's the one I want, just the one I need. How much is it?"

The storekeeper, somewhat surprised, hurriedly closed the deal, with a sidelong glance at the company by the stove.

As Jackson picked up his bundle and proceeded to depart someone asked in a joking spirit:

"Are you going to peddle those things this winter?"

"No, sir," Jackson answered. "I am going to read them."

"Ah, I see," old Lanigan broke in, "I suppose you feel that you can't run a boat without them."

"Well, it isn't exactly that," said Jackson, as he took the seat offered him by the stove. "But I'll tell you how it came about, and then you can all do as you please, but for me I'm going to buy books, and a lot of them.

"I have put in the summer in the Magnolia, and you all know what a crazy old tub she is. Most of you have been in her some time or other, and I doubt not that most of you have been up against that pump she is fitted with. It's just a common, everyday, ordinary pump, a horizontal duplex pump; but it is the most cantankerous, ornery, refractory pump that I ever came in contact with."

"I know her," old Lanigan supplemented, "I have been up against her, and she nearly drove me to the bug house."

"As I was saying," Jackson continued, ignoring the interruption, "she was a bad pump, and more than once I have threatened to smash her with a sledge. You know there is nothing meaner aboard ship than a refractory pump. Half of the time this one would not work at all, and, of course, it always happened when you was in a hurry. When she did work it was in a sort of a spasmodic, one-legged way that would make you get up out of bed at night and go to see the doctor about your nerves.

"Well, sir, that pump became the hoodoo of my life. I got so that I was afraid to look at her. I used to dream about her at night. The trouble with her was that one could not see anything wrong with her. I dissected her bit by bit and put her together carefully, but nary a difference did it make. I tried new packing, new valves, more vent and larger airchamber, all with the same result, and then I made up my mind that she was simpy hoodooed, and let it go at that."

"Jackson, you ought to have known better than to fool away your time with that pump, a dozen engineers had tried that before you," said Lanigan.

"Yes," Jackson continued, "but then the trouble was somewhere, and I figured, seeing I was the engineer of the boat, it was up to me to remedy it.

"Still we got along somehow, until one day, when we had her on the boiler with the water pretty low, she gave one squeal like the wail of a lost soul and stopped stock still. There were things doing then. I dissected her and worked at her until I was fit to be placed in a straight jacket. The second soothed my ruffled temper some and took a round with her himsef. It was our only available boiler-feed at the time and it was plain that something had to be done, but what to do, that was the question, there seemed to be nothing the matter with the pump; still the best we could get out of her was a halting one-sided jerk which would not put any water in the boiler.

"The whole engine room force was gathered around that pump, and the atmosphere was blue, even the stokers took a share in the discussion of the trouble. We were all agreed that the trouble was somewhere in the valves of the steamchest. But, good God! I had set them myself three different times, and the second had gone over them twice. So when a young stoker ventured the remark, that, perhaps, the valves were not set right, my first impulse was to knock him down with a monkey wrench, and had I been in my right mind I would surely have done it. What business did a common stoker have to criticise my ability at setting valves? Yet, when he made that remark he was well out of my reach, and besides I suppose I was laboring under one of those brainstorms you read about. Anyhow, all I did was to give him a sharp look and say: 'What in blazes do you know about setting valves?'

"'Well, sir,' he answered, 'I used to know how, learned it out of the book, but I've forgotten now. I have the book, though.'

"This was adding another insult, but, as I said before, my brain was in such a whirl that I was not responsible, and for the sake of taking revenge on somebody I snapped: 'Get your confounded book, and get it quick, and let's see you set them!'

"By the time he came back the water in the glass was out of sight, and I was acting more and more like a lunatic. So when he began to read out of that book I actually laughed, it was comical to think that anything as easy as that sounded to be would cure that pump.

"'Here it is,' he began, 'to set the valves of a duplex pump. Place the rocker-arms perpendicular and then place the valves centrally over the ports.'

"The whole thing sounded funny to me, and I wanted to get even with somebody and didn't care who. So when the second asked me, 'shall we try it, sir?' I told him, that I didn't care if they brought the bible and set the valves by that. And I further told them, that I didn't care if they blew the whole caboodle to kingdom come, because I was through with the whole disgusting business.

"With those words I left the engine-room. And you can believe me or not, when I came back, expecting to see them in confusion and at their wit's end, that pump was trotting along as quiet and well behaved as any pump you ever saw, and sending the water into the boiler at a rate to astonish any ordinary steamboat engineer. And from then until this day we haven't touched her, and she has never bucked, kicked or even given a little grunt.

"Now let me tell you that I am not the man to have some kid fireman tell me how to run my steamboat. No, sir, I'm going to get the books and learn it myself. That's the reason I bought this one, and I'm going to take it home and read it through from cover to cover. Then I'm going to buy another and read that through, and so on. As for you, you can all do as you please, and have the stoker with the book learning do your work for you if you want to."

With this parting shot Jackson left the store, his cherished possession safely tucked under his arm. The store keeper had walked back of the counter containing the books. And soon trade became brisk. One by one the men left, each one minus a $5 bill, but with a package wrapped in strong brown paper.

If anyone had hung around outside the store until night had wrapped mother earth in her sable mantle, he would have seen old Lanigan sneaking

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home by the most obscure streets. On his face there was a guilty look, and under his left arm he carried a bundle nearly 12 inches square.

CREWS OF VESSELS.

The Goulden bill, the provisions of which as originally drawn gave the interests on the great lakes some concern, especially the passenger lines, has been so amended as to be quite satisfactory. Instead of providing that at least 75 per cent of the deck crew, exclusive of licensed officers, shall be able seamen, it has been so amended as to provide that the vessel shall carry such complement as in the judgment of the local inspectors may be necessary for her safe navigation. Concerning the bill the committee reports:

"The bill is an affirmation of the principle of federal control of navigation in an important respect in which such control has been lacking, although essential in the judgment of the committee and the department of commerce and labor. Hitherto the laws have provided for the inspection of hulls, boilers and engines, for life-saving and fire-fighting appliances, and for many of the mechanical details of a vessel. They have failed to provide adequately for the officers and crew necessary to man the vessel and to work its machinery and appliances. Section 4463 of the Revised Statutes, for which this bill is a comprehensive substitute, was enacted 37 years ago, and imperfectly atempted to fix the number of officers and crews of passenger vessels. The steamboat-inspection service has endeavored to supplement that law by regulations in the interest of safety, but these regulations have been declared invalid by the courts and by the department of justice.

"The bill empowers the board of local inspectors of hulls and boilers to fix the complement of licensed officers and crew necessary for the safe navigation of each vessel of the United States, subject to federal inspection, whatever be its type—freight, passenger, towing vessel, etc. Vessels under five net register tons are usually outside the statutory definition of a vessel of the United States, are too small to require federal prescription of the crew, and are accordingly exempt from the requirement proposed.

"The local inspectors are the officers who inspect annually and oftener, if need be, the hulls, boilers, machinery, and equipment of each vessel subject to the inspection laws. They have an intimate acquaintance with the details of all the inspected vessels in their respective districts, the trade in which they are employed, the hours of their navigation, the nature of the waters they traverse, and the amount of work on board. These local inspectors, accordingly, are the most competent federal authorities to determine at all times the number of officers and men required on any given vessel.

"The power bestowed by the bill upon the local inspectors is a large power, but the committee does not deem it practicable so to classify vessels by statute that the number of officers and crew could be fixed intelligently by act of congress. To be just and practicable, such a general statute would have to be accompanied by a long list of statutory exceptions and special rules, which would have to be modified or added to, perhaps, at every session of congress. In fact, the committee was requested to include in the bill special exemptions for freight vessels, a special 12-hour rule for certain lake tugs, a rule for certain towboats on the Ohio, and other propositions were alluded to. Doubtless there was merit in some or all of these special suggestions, but the committee decided that such details can better be determined by local administrative officers knowing all the facts than by a committee of congress. The powers vested in the local inspectors are safeguarded by an appeal from their determinations, first to the supervising inspector, and, if necessary, to the supervising inspector-general.

"The bill, by bestowing upon local inspectors the power to fix the complement of officers and crew necessary to the safe navigation of any vessel, thereby also bestows in effect the power to regulate the number of hours of labor on shipboard. The bestowal of such a power of regulation, adapted to varying conditions as they exist on various types of vessels, in various positions on board such vessels, and on various waters, the sea, the lakes, and the rivers, marks a distinct advance in legislation in the interest of labor. Safeguarded, as proposed by the bill, that power can be exercised to secure justice both to labor and capital."

ELECTRIFICATION OF STEAM ROADS.

Mr. C. L. de Muralt, consulting engineer and professor of electrical engineering at the University of Michigan, is giving a course of lectures to the senior electrical engineering students at Ann Arbor on the "Electrification of Steam Railroads." Prof. de Muralt, who has been lecturing during the last semester on the underlying phases of this subject, such as the power station equipment, transmission and working conductors, motor characteristics, etc., intends to supplement these by a discussion of the technical and commercial features of the following subjects: (1) "The General Electrification Problem"; (2) "The Reasons for Electrification"; (3) "The Operating Characteristics of Steam and Electric Locomotives"; (4) "The Choice of Electric Systems"; (5) "An Analysis of the Cost of Operation"; (6) "The Field of Railroad Electrification. The Congested Terminal, the Mountain Grade, and the Trunk Line," and (7) "Preparation of an Electrification Project for a Particular Road," special attention being directed to such problems as the design of locomotives, the calculation of run sheets, the choice of speeds, study of the peak load, the location of substations, the economics of transmission and other collateral topics.

CRUISING YACHT LYDIA.

The sea-going gasoline cruising yacht Lydia has been sold by John L. Roper, of Norfolk, Va., to John W. Eddy, of Seattle, Wash., through the agency of Stanley M. Seaman, 220 Broadway, New York. Built 1907 by Williams-Whittlesey. She is 75 ft. over all, 14 ft. beam, 3 ft. 6 in. draught, with 50 h. p. Standard engine. Cabin gives double and single stateroom, large saloon, two toilets and galley. Considerable difficulty was experienced in arranging for shipment, there being few American ships capable of handling a yacht of this size on deck. Freight was finally obtained on the new steamer Geo. W. Fenwick, built at Newport News, Va., for the Hammond Lumber Co., of San Francisco. Yacht was loaded at the Baltimore Steel Co.'s pier, Baltimore, and passed out Cape Henry, Feb. 18. Ship expects to go through via Straits of Magellan without a stop, enough coal for the trip being carried in hen hold. This is the largest yacht ever shipped from the Atlantic to the Pacific intact.

The Merchants' and Manufacturers' Association, of Milwaukee, has protested against the deep waterway from Chicago to the Mississippi on the ground that a diversion of the flow of Lake Michigan water would lower the level of the lake and seriously impair the movement of the great freighters in the harbors.

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SITUATION AT THE SAULT.

When one considers that the interest of navigation is paramount to all other interests it seems strange that purely private interest could over a series of years blockade the adequate development of a navigable waterway, especially so when a commerce is concerned whose nature and continued development is necessary to the well-being of a whole people. It is only a question of time when all the space available to the international line of St. Marys rapids will be needed for locks; and yet litigation among purely private interests has prevented the development of artificial channels at the Sault and has inevitably postponed the date of their completion beyond the time that they will be actually needed to care for an ever-increasing commerce. There are at present two locks at the Sault. The second lock, which is the largest artificial chamber in the world, was supposed by its designers to be adequate for an indefinite period of time; but commerce had outgrown it before the water was even let into its completed chamber.

A third lock is now needed; a fourth and fifth will be needed later. There is no doubt that the whole of the rapids will eventually be needed and the government should make provision for its reservation. The text of the Young bill, which is an amendment to the river and harbor act, is printed herewith, the additions in italics and the omissions in parenthesis:

Improving St. Mary's river at the falls, Mich.: For the construction of a new lock, with a separate canal, in accordance with plan "Three," set forth in house document numbered 333, fifty-ninth congress, second session, $1,200,000: Provided, That the secretary of war may enter into a contract or contracts for such materials and work as may be necessary for the construction of said lock and canal, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate $5,000,000, exclusive of the amounts herein and heretofore appropriated or heretofore authorized.

And it is further provided, That the work of improvement shall proceed without delay by reason of conflicting or other claims of title or interests and without prejudice *to* any pending litigation in reference thereto.

And all lands and waters north of the present St. Mary's Falls ship canal throughout its length, and lying between said ship canal and the international boundary line, needed in connection with the execution of this project, or any project heretofore adopted by congress, for improving St. Mary's river at the falls, aside from lands owned by the Unted States, all of which are hereby made available for said project, shall be acquired in the following manner, and under the following conditions, *provided that the secretary of war may in his discretion also acquire in the same manner such other lands and waters in said river as he shall deem necessary for the building of a third canal and fifth and sixth lock:*

The secretary of war may, in his discretion, enter into negotiations with any persons or corporations claiming title to any portion of the land or waters required for the construction of the said canals and may acquire title to such portions of such river or lands as may be required for its construction and operation, *upon such terms and conditions, including a grant to use and occupy for water power purposes, such portion of the bed and water of St. Mary's river not needed for the purpose of navigation as he shall deem for the best interest of the United States,* but any agreement made by him shall be without prejudice to any claim of title by the United States (and without the grant of any rights or privileges in said river or lands therein which shall create a right to compensation in case any further portion of said river or said lands therein between the canal herein provided for and the international boundary line shall be hereafter required for purposes of navigation). Portion in parenthesis omitted.

If such lands and water can not be obtained in the manner and under the conditions above set forth the same shall be acquired as follows:

The secretary of war may cause proceedings in condemnation to be prosecuted under existing law, or a copy of the said number three, on a large scale, shall be prepared and exhibited in the office of the United States engineer at Sault Ste. Marie, and the attorney-general shall proceed to ascertain the owners or claimants of the premises embraced therein, and shall cause to be published for the space of 30 days, in one or more daily newspapers in the city of Sault Ste. Marie, that the same has been taken for the uses mentioned in this act, and notifying all claimants to any portion of said premises to file, within its period of publication, in the department of justice, a description of the tract or parcel claimed and a statement of its value as estimated by the claimant. On application of the attorney-general, the presiding judge of the circuit court of appeals of the United States for the sixth circuit shall appoint three persons, not in the employ of the government or related to or in any manner connected with the claimants to act as appraisers, whose duty it shall be, upon receiving from the attorney-general a description

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of any tract or parcel, the ownership of which is claimed separately, to fairly and justly value the same, and report such valuation to the attorney-general, who thereupon shall, upon being satisfied as to the title of the same, cause to be offered to the owner or owners the amount fixed by the appraisers as the value thereof; and if the offer be accepted, then, upon the execution of a deed to the United States in form satisfactory to the attorney-general, the secretary of war shall pay the amount to such owner or owners from the appropriation made therefor in this act.

(In making the valuation the appraisers shall only consider the present value of the land or property acquired without reference to its value for the uses for which it is taken under the provisions of this act.) Portion in parenthesis omitted.

The appraisers shall each receive for their services $10 for each day's actual service in making the said appraisements.

Any person or corporation having any estate or interest in the premises, who shall for any reason not have been tendered payment therefor as above provided, or who shall decline to accept the amount tendered therefor, may at any time within one year from the publication of notice by the attorney-general as above provided, file a petition in the court of claims of the United States setting forth his right or title and the amount claimed by him as damages for the property taken; and the court shall hear and adjudicate such claims in the same manner as other claims against the United States are now by law directed to be heard and adjudicated therein; Provided, That the court shall make such special rules in respect to such cases as shall secure their hearing and adjudication with the least possible delay.

Judgments in favor of such claimants shall be paid as other judgments of said court are now directed to be paid; and any claimant to whom a tender shall have been made, as hereinbefore authorized, and who shall decline to accept the same, shall, unless he recover an amount greater than so tendered, be taxed with the entire cost of the proceeding. All claims on account of ownership of any interest in said premises shall, unless petition for the recovery thereof be filed within one year from the date of the first publication of notice by the attorney-general as above directed, be forever barred: Provided, That owners or claimants laboring under any of the disabilities defined in the statute of limitations of the state of Michigan may file a petition at any time within one year from the removal of the disability. Upon the publication of the notice, as above directed, the secretary of war may take possession of the premises embraced in said plan numbered three, and proceed with the construction herein authorized; and upon payment being made therefor, or without payment, upon the expiration of the time as above limited, without filing the petition, absolute title to the premises shall vest in the United States, and no permits shall be granted to occupy any portion of the land or waters of St. Mary's river in the locality for said ship canal herein provided for, or between the same and the international boundary line, *except as herein provided for,* except upon the express condition, accepted by the grantee therein, to the effect that the erection of the structures or the utilization of water power shall create no rights against the United States in case the whole or any part of the said river or the lands therein is required for the purposes of navigation, and further, that such structures or rights so granted shall be surrendered to the United States without cost when so required for purposes of navigation aforesaid, and any and all rights under any permits or licenses heretofore granted shall be deemed to be revoked unless such permits or licenses are reissued upon the terms that further improvements and expenditures shall entitle the licensee to no greater consideration than such licensees are now entitled to, if any; but nothing herein contained shall be held to imply that any right now exists to compensation on account of expenditures made or alleged claims under licenses heretofore granted. *Nothing herein contained shall be held to affect existing riparian or other rights of any person or corporation, or the existing remedies therefor or any action at law or equity now pending.*

(The secretary of war may acquire lands for the location of remedial or compensating works to the extent required to enable the Michigan-Lake Superior Power Co. to comply with the provisions of the river and harbor act of 1902, but such lands, if so acquired, shall be obtained without expense to the United States.) Portion in parenthesis omitted.

NAVY SUPERVISION FOR THE MERCHANT MARINE.

Editor MARINE REVIEW:—I yield to no one in earnestness of good wishes for the upbuilding of the merchant marine, in fact I can hardly welcome the emasculated measure now before congress even on the theory that half a loaf is better than no bread—it is not much more than a crumb, and grudgingly given at that. But I hope the day will never come when the suggestion contained in the prize essay in the REVIEW of the 26th, providing that the navy department should supervise the plans and construction of ships to entitle them to bounty, is adopted.

No owner or company in the world could show a profit in earnings on such an investment as that means, even with any bounty that the most prodigal congress will ever grant. I should oppose to the last any support whatever, conditioned upon any such consideration. The navy department, with its different bureaus, absolutely does not know what a dollar means. If congress, and the people of this country who furnish the money, realized how it is spent they would sweep the department out of existence. It is so bound up in tradition and red tape and fool notions as to inspection and specifications, so honeycombed with jealousies and so entirely lacking in ordinary business instincts, that the hundreds of millions so freely voted melt away through its hands like snow.

For a specific instance applicable to the question at hand take the two colliers Vestal and Prometheus, authorized April, 1904, and "urgently needed" and for which was asked and appropriated $3,100,000. These ships are 465 ft. long over all, 60 ft. beam and 34 ft. depth, and are to carry about 6,000 tons of coal on a draught of 26 ft. with a displacement of 12,500 tons. In other words the ship herself weighs 52 per cent of the total. They are to be fitted with twin screws, 7,500 horsepower, and are to have a speed of 16 knots loaded. They are each to carry a complement of 232 officers and men. Just think that over a little. Twelve thousand five hundred tons displacement, 7,500 horsepower, 16 knots, 232 men and $1,550,000 to carry 6,000 tons of coal. What a farce! And the report of the sec-

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retary just submitted to congress shows one 31 per cent completed and the other 1 per cent or hardly begun. After four years! And now there is pending an appropriation of $7,000,000 to build four more. Seven million dollars for four coal ships! Heaven only knows what the cost of a mail ship would be if the navy had a finger in its construction. On the great lakes there has been built, not a 6,000-ton ship, but a 10,000-ton ship, and put in commission in 70 days and at less than one-fourth the cost. Dozens of them are built in very little longer time. Treble the time and double the cost, if you please, for a sea-going ship, and then you would have far greater capacity for less than half the cost and in a fraction of the time. And all for what?

There are now on the navy list 16 colliers and yet not one was available for the fleet on its recent Pacific cruise. Why? Read the bureau reports. Repairs. Special service, etc. And now we want six more to lay up alongside of them, if they are ever finished. No navy interference in mine.

Something has been said of late about the navy but the surface hasn't been scratched yet. Let any man who knows ships and ship construction and shop and yard practice visit the navy yards and the naval vessels under construction in private yards and examine the bureau reports (which, after all, are of value chiefly for what they don't tell), and then, if he contemplates investment, say how he would like to be tagged "Inspected by the U. S. Navy."

The money for these two colliers comes pretty near to all that the ocean mail act will distribute to the merchant marine. For that matter the merchant marine would come along faster if the navy did not exist at all, and it never will come in the world if the navy has anything to do with it along the line suggested and it requires a million and a half for a 6,000-ton coal ship and an eternity to build it.

STARBOARD WATCH.

Philadelphia, March 28, '08.

The Northern Specialty Co., Utica, N. Y., manufacturers of Northern Self-Closing Safety Water Gages and Northern Self-Closing Safety Check Valves for water gages, have just put out a catalog descriptive of these devices. These devices have received the endorsement of the boiler insurance companies. The catalog enters into a detailed description of them and will be sent to anyone upon request.

IN THE FOG.

The fact that a steamer, in mid-ocean, is not slowed down to a snail's pace or brought to anchor when suddenly immersed in a fog is at times a matter of considerable comment and severe criticism on the part of the uninitiated passenger. It is of little moment to him that the horn is bellowing forth warnings every half-minute or less, that the water-tight bulkhead doors are either closed or ready to close at a moment's notice, and that extra officers are on duty both on the bridge and in the engine room. He is not aware that at the first faint sound of an approaching horn his vessel would be slowed down till she had barely steerage way, or that in a fog the ocean is about the safest place any ship master could wish for. Recent events in and around our harbors would substantiate this latter statement. Take, for instance, the recent ramming of the Kronprinz Wilhelm in New York harbor, where fogs are frequent and thick, and accidents, due to conjested harbor traffic, are many.

On March 18 a dense fog blanketed the East and North river and stretched far out past the Hook, causing considerable delay among incoming shipping and no little confusion among harbor craft. Through the murk the big North German Lloyd liner Kronprinz Wilhelm picked her way from Quarantine to a point off Robbin's reef, where the anchor was dropped to await the lifting of the fog. Somewhere astern of the Wilhelm the freighter Crown of Castile was also creeping Hobokenward. Fog bells were ringing on the Kronzprinz Wilhelm and the Crown of Castile, and the horns of these and countless other craft split the air. Combined signals are at times confusing, and must have been if anything more so on this occasion. The result was that the Kronprinz Wilhelm, anchored directly in the track of the bulky freighter, received the steel bow of the tramp in her stern overhang. When the vessels parted there was a triangular gap of about 15 ft. in length in the hull of the mail steamer.

The Kronprinz Wilhelm, like all liners of recent construction, is divided into a number of water-tight compartments. In the bulkheads dividing these compartments are the water-tight doors, 48 in number, operated by hydraulic pressure and controlled by electricity from the bridge. An indicator arranged to show one light for each door closed is also on the navigating bridge, and is so constructed that any individual door not properly closed can immediately be detected by the failure of the light to appear. By pulling a lever on the bridge bells in the vicinity of the doors ring for the space of five seconds, at the termination of which time the doors begin to descend. Each door closes with a force equal to three tons, and can also be operated by hand power.

As a demonstration of the efficiency of this system—the Stone-Lloyd, invented by an engineer of the North German Lloyd—the ramming of the Kronprinz Wilhelm was invaluable. Exactly 15 seconds after the pulling of the signal lever on the bridge, all water-tight doors were closed and the vessel made practically unsinkable. Happily, the damage was done far above the water line, but it is not what did happen so much as what might have happened.

PIG IRON SITUATION.

While some signs of improvement in the pig iron market are noted in the east, the central west has developed little business but considerable cutting of prices. The Cleveland agreement as to prices in central western territory is now observed by so few producers that little is heard of it, and orders are freely taken at $15.50 valley for No. 2 foundry, while other furnaces are quoting as low as $15.25, and one Ohio interest sold a fair tonnage for eastern Pennsylvania delivery at $14.75 the furnace. During the past month, the principal erector of structural material has booked a very small volume of orders, and a large percentage of the limited business taken has gone to independent interests. Railroads are showing more disposition than for some time to make repairs, and some orders for cars, axles, and kegs of nails are reported, but there is still much uncertainty as to the ability of railroads to meet obligations and arrange for new expenditures. Orders for tin plate and wire goods are coming in in satisfactory volume. The coke market continues dull, production very low, and prices uncertain. Scrap iron is much depressed, the tendency being toward lower prices. Some furnace interests have begun agitating in favor of lower prices on iron ore, but sellers are firm in adhering to quotations, and there is no prospect that concessions will be made.

Edwin B. Lausier has resigned as sales manager of the motor department of the American & British Mfg. Co., Bridgeport, Conn., to accept an important position with the Timken Roller Bearing Axle Co., of Canton, O.

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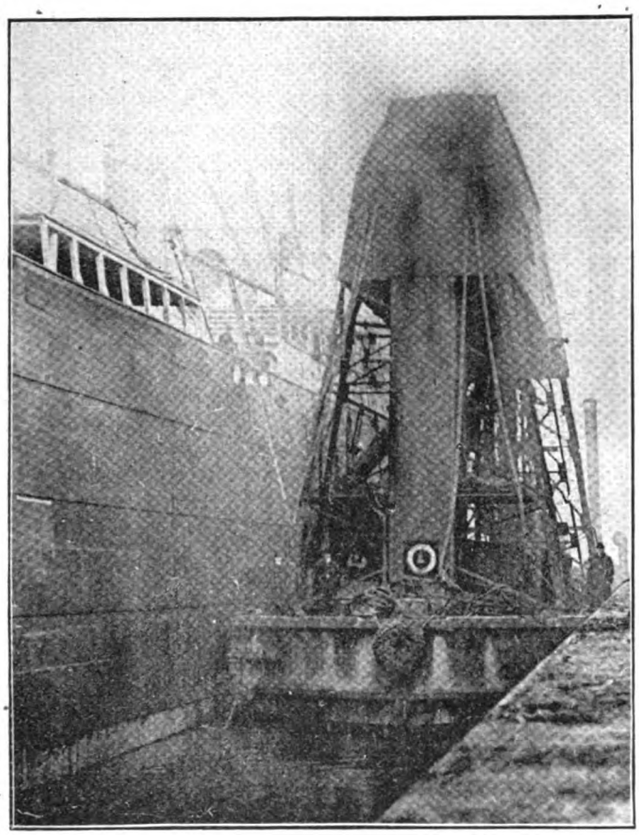
AUTOMATIC BUNKERING AT THE PORT OF LIVERPOOL.

P. B. Clarke, an American, who some two years ago came to Liverpool and formed the Liverpool Barge & Coaling Co., and has had several automatic coaling barges built on results that had been obtained with similar craft in New York, has worked wonders in that time in almost revolutionizing the method of bunkering ocean-going liners on the Mersey. The old method of coaling ships, whether by hand or tip, was admittedly behind the times and was besides too tedious and expensive a process to continue long in use. Since the introduction of the Clarke's automatic system, experience has shown that everything claimed for it at the outset has been more than realized, and ship owners have not been slow to appreciate the great possibilities and advantages which it carries in their favor. The Clarke automatic coaling barge will be so well known to readers of the MARINE REVIEW that a description is hardly necessary here, but it may be at once said that Liverpool ship owners are more than satisfied with its introduction at the Mersey port, for they have found it not only economical, but rapid, and able to handle any kind of coal, freedom from the dust nuisance attendant on hand coaling and at the tips, mobility (so that the coaling can be done whether the ship is on dock or in the river), ability to do the coaling at night so as to prevent interference with the handling of cargo in the day time, and automatic weighing and self-registration of weights. The main purpose of this article is to show the latest achievement of the Clarke's system in the bunkering of the White Star liner Suevic, and the accompanying illustrations will demonstrate that these coaling barges possess all the advantages which have been above narrated. Within 20 working hours no less than 3,000 tons of coal were put into the Suevic's bunkers from the barges, and of this amount 2,100 tons were put into the ship through the side ports. The operations with these two tower barges were carried on simultaneously on the port and starboard sides of the ship as she lay in the Canada dock shortly after arriving from Southampton, where she had had a new bow built into her after being ashore near the Lizard. The balance of 900 tons were bunkered from a third barge of the high tower pattern. The chutes from this machine feed "over all" into any bunker entrance on the ship's deck, and when necessary a chute may be worked on both the port and starboard sides of the deck. The speed at which coal can be put into the bunkers of a ship by this system is from 100 to 150 tons an hour for each barge. Since these coaling barges were first introduced at the Mersey port, they have been working up to the fullest expectations, and ship owners now wholly believe in their efficiency and the system they embody.



CLARKE'S LOW TOWER BARGE BUNKERING SUEVIC ON THE PORT SIDE.

CLARKE'S LOW TOWER COALING BARGE BUNKERING SUEVIC ON STARBOARD SIDE.

Work has been begun on section 2 of the new Livingstone channel in the lower Detroit river. The section will take three years or more to complete, at a cost of about $1,600,000. The section covers a distance of 8,000 ft., beginning at the old Canada southern bridge and extending to Stoney island. The section will be built in the dry after the manner of the West Neebish improvement.

The Port Huron Transportation & Wrecking Co. has given contract for raising the old barge Albany sunk at Marine City.

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LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

Fig. 20 shows side stringer fitted intercostally between the web frames.

This arrangement is the latest on the great lakes, the connection to the web frame being made as strong as at the weakest part of the stringer.

The weakest part of this stringer is through the line of holes punched for channel marked K which runs from the ship side to the tank side plating being a brace from the frame to the tank side.

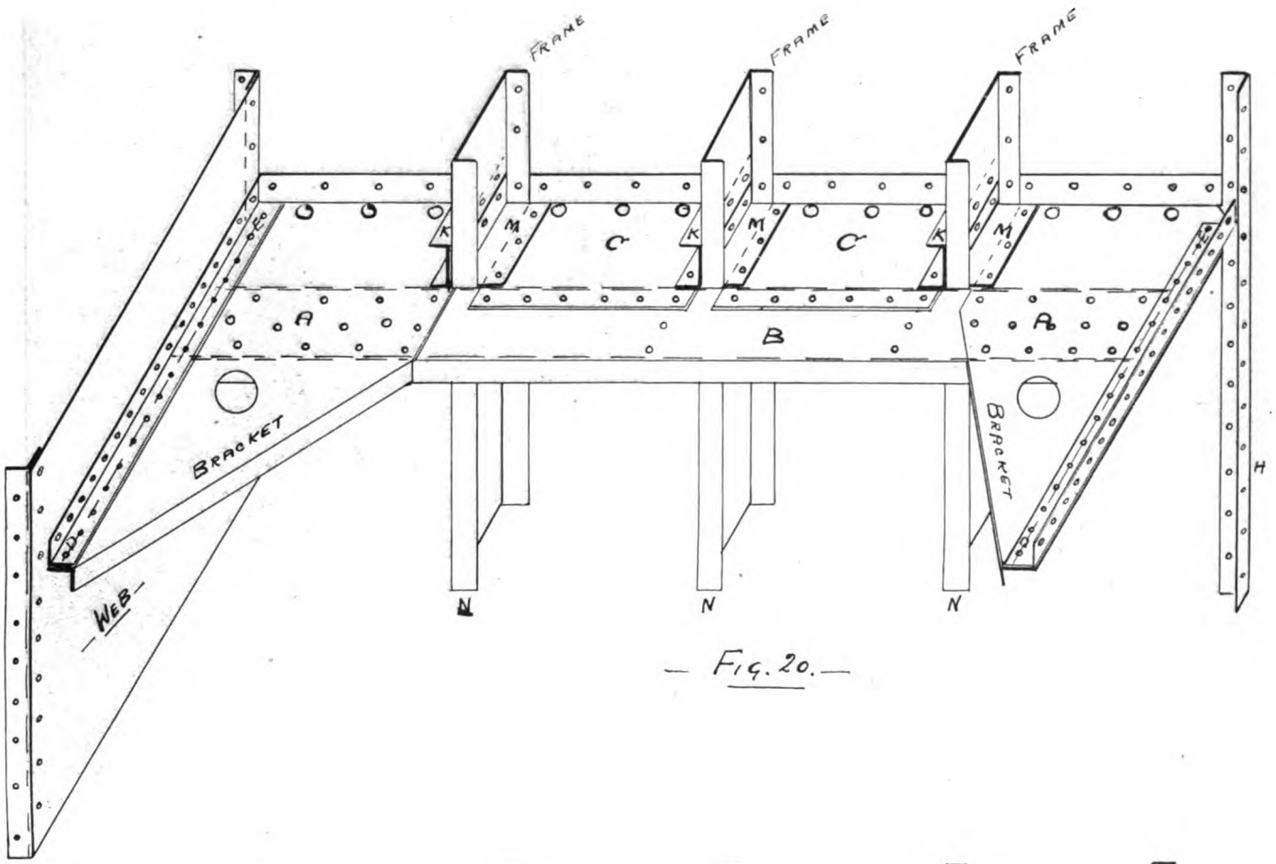
There are three rivets through this channel which connects the intercostal C and channel K together.

The tensile strength of the stringer channel B minus the rivet holes for channel brace equals 154 tons. The intercostal C is connected to the frame with a clip M which has three rivets ¾-inch diameter then 154 + 36 for rivets equals 190 tons.

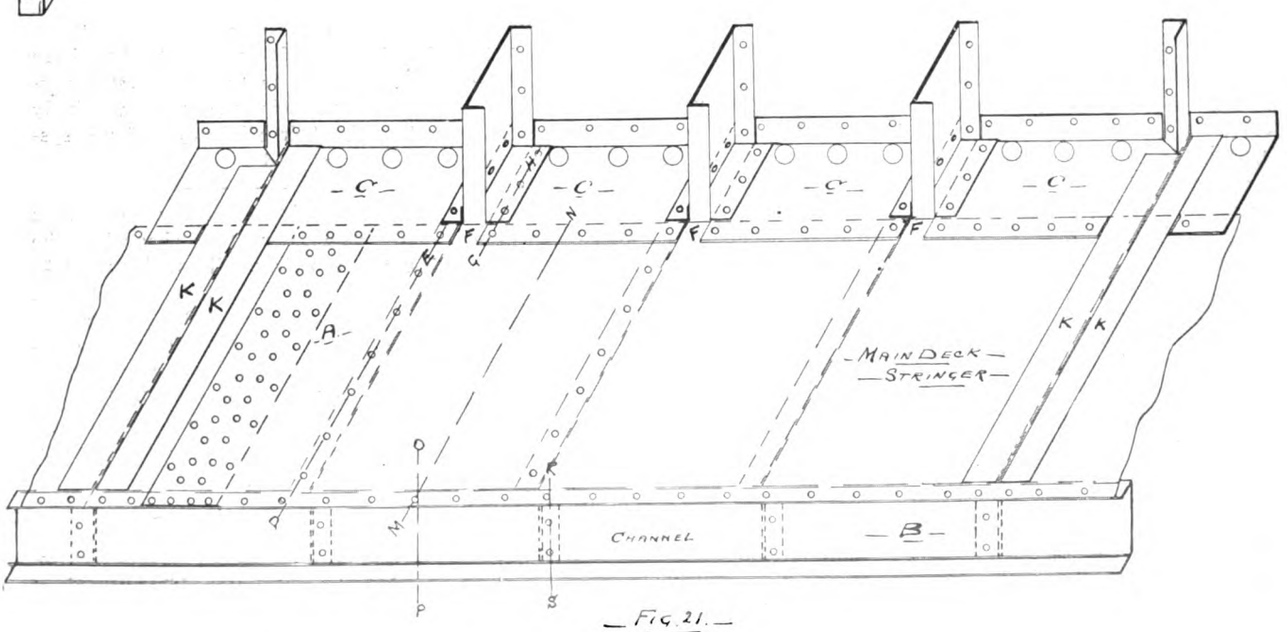
$$\frac{190}{12} = 16 \text{ rivets.}$$

It is necessary to connect the channel B to the web frame with 16 rivets ¾-in. diameter to obtain the strength of the weakest section of side stringer.

This connection is governed by the area of section of the channel B and must not be less in any case.



— Fig. 20. —



— Fig. 21. —

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NAVIGATION DURING MARINE PARADES.

Representative Greene has introduced in the house of representatives a bill to authorize the secretary of commerce and labor to issue from time to time such regulations as may be needed to promote the safety of life on navigable waters during regattas or marine parades. The purpose of the measure is to give the local inspectors at San Francisco authority to cope with the situation when the battleship squadron gets there. Concerning the bill Secretary Straus writes:

"In reply to your request that I furnish the committee with such suggestions as I may deem proper touching the merits of the bill and the propriety of its passage, I have to say: I approve the bill, and it is satisfactory to the secretary of the treasury and approved by the secretary of the navy.

"On the arrival of the American battleships late in April or early in May the approaches and harbor of San Francisco will be thronged with all types of vessels, crowded with sightseers to welcome the fleet. The occasion will equal and perhaps transcend the international yacht races for the America's cup in the number of vessels under way or at least in the eagerness of their owners and masters to secure advantageous positions to view the parade. Such occasions usually lead to more or less reckless navigation on the part of some to the danger of many. The federal and local officers at San Francisco consider it important that special navigation rules be framed to guard against any accident or untoward occurrence to mar the celebration. They can not be effective without action by congress.

"The risks connected with the international yacht races led congress to pass the act of May 19, 1896, relating to regattas. It would be palpably absurd to call the arrival of the fleet a regatta, although the conditions on the water will doubtless be similar to those which the regatta act of 1896 has imperfectly met. Next September similar conditions will probably be repeated in New York harbor and on the Hudson river at the Robert Fulton celebration, and in 1911 when the centenary of the first steamboat on the Mississippi is celebrated. Doubtless other marine events hereafter may assume proportions requiring in the interest of safety to life special action by one or more of the federal departments concerned with marine affairs.

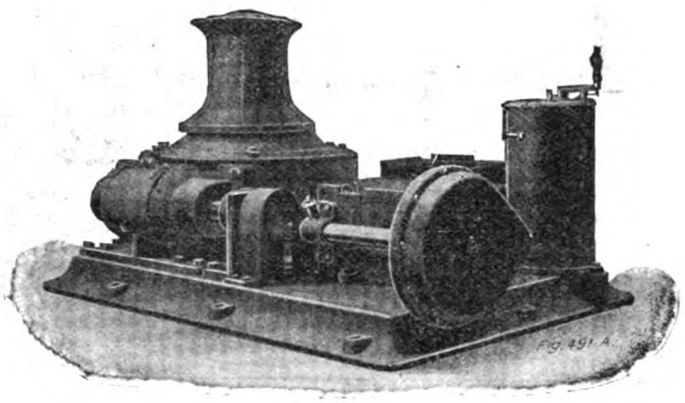
"The bill is designed to be broad enough to provide for safety to life on navigable waters during any important event bringing together many vessels crowded with passengers when the ordinary navigation rules should be supplemented. As the secretary of commerce and labor is in general charge of shipping matters, including the regatta act since July 1, 1903, the bill vests him with administration generally. It provides, however, in section 3 for the transfer of administration by the president to another cabinet officer on special occasions where propriety may suggest such transfer.

"The second section provides a patrol fleet for police purposes on such occasions. It can be drawn from various sources at various places. Thus sometimes the navy department can furnish torpedo vessels; the treasury department, revenue cutters; the department of commerce and labor, lighthouse tenders, and Coast and Geodetic Survey, steamers; and on the Mississippi, should occasion demand, the war department can furnish steamers, etc., employed by the engineer corps. At the international yacht races, owners of yachts tendered to the government the use of their vessels for patrol purposes, and on other occasions yachts, tugs, etc., would doubtless be tendered without pay from courtesy or for the destinction.

"The penalties proposed are those which seem most efficacious to prevent accidents. The regatta act of 1896 lacked penalties. For careful navigators no law and no penalty, of course, are needed. On such occasions, however, excitement in some instances and the desire to make money in others lead some masters and owners to reckless disregard of the safety, rights and enjoyment of law-abiding citizens. The bill may be the means of preventing catastrophes during festival occasions."

ELECTRIC GYPSEY.

The American Ship Windlass Co., Providence, R. I., have placed upon the market an electric gypsey which is meeting with favor. This machine was designed for practically the same purpose as the steam machine for use upon wharves, warehouses and general hoisting purposes. The company has furnished a number of these machines for hauling cars and also for hauling teams up the steep inclines from ferries at low tide. They are made both worm and bevel gear driven. This machine has been developed throughout along the lines of maximum duty at low cost, together with large factors of safety in all parts. When worm geared it gives exceptional power with comparatively small motors.



ELECTRIC GYPSEY.

Allis-Chalmers bulletin No. 1707 contains 20 illustrations of log or timber conveying machinery. The careful attention that company has devoted to this class of apparatus has made its chains a feature in all the mills where they have been installed. One kind of conveyor, which is described in this publication, is formed by links cast in one piece, and has a newly devised interlocking joint, with a cross bolt and nut bolt to hold the nut and bolt from turning; at the same time the nut can be forced off with a wrench whenever necessary to separate the links. The joints can be sprung apart after removing the bolt. The joints interlocking largely sustain the strain and are practically dustproof. Space does not permit giving detailed information on these chains, but a copy of the above bulletin may be had upon application to the Allis-Chalmers Co., Milwaukee, Wis.

The G. M. Yost Manufacturing Co., Mechanicsburg, Pa., manufacturers of high grade vises, are moving to their new plant at Meadville, Pa.

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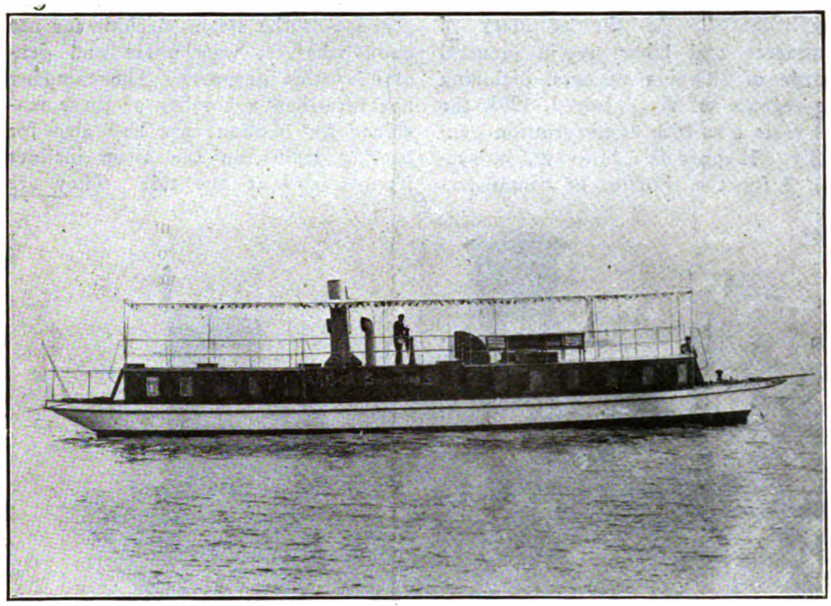
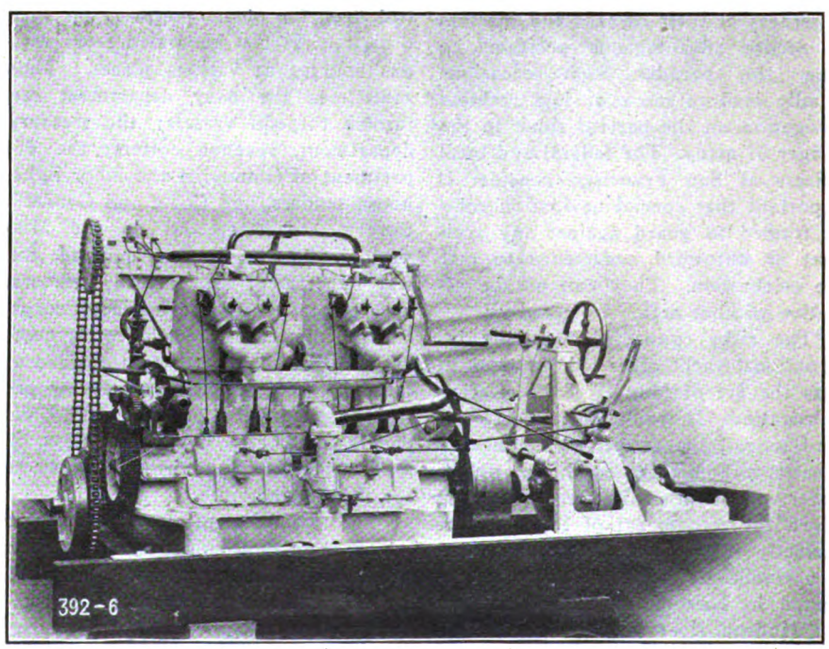
BRITISH-BUILT MOTOR YACHT FOR RUSSIA.

Messrs. J. I. Thornycroft & Co., Ltd., of Chiswick and Southampton, have just built the motor yacht Swietlana, which we illustrate, to the order of a Russian gentleman, and intended for use on the rivers of Central Russia. Her dimensions are: Length on deck, 78 ft.; length water line, 70 ft.; beam, 13 ft.; depth, 4 ft. 9 in.; and the draught loaded (on trial), 1 ft. 9 in. Two Thornycroft's motors are used for the propelling machinery, and each of these has four cylinders of a diameter of 6 in., with a stroke of 8 in. Each motor will develop 50 B. H. P., which is transmitted to twin propellers, specially arranged in tunnels which allow of proper immersion. The motors are also shown in the accompanying illustration. The machinery is of the type which has for some time been supplied by Messrs. Thornycroft for similar purposes, and has been larely adopted for government, mercantile and pleasure craft. The fuel used is ordinary commercial paraffine and not petrol spirit, though the latter may be used if desired by employing a special type of change-over throttle-valve, by means of which the carburetor, when petrol is used, is in connection with the inlet pipe of the motor. When arranged for paraffine however, the vaporizer is connected in place of the carburetor. In either case the exhaust is taken through the vaporizer, so that when the change is made from petrol to paraffine, it can be done instantly. There is a distinct economy obtained from the use of paraffine, as compared with petrol, which is a special feature of the engines. The exhaust gases are led from the motors into a silencer fitted in the funnel, and when required the gases are used for operating a three-toned signal horn. Siemens-Martin steel plates, galvanized, were used for the hull. Very ample and convenient accommodation is provided internally. It will be seen that a commodious saloon extends across the fore part of the vessel in which there are sofa seats, sideboards, a dining table, and other accessories. Aft of this saloon are two state rooms, each with berth, folding lavatory, and the usual fittings. The yacht, both internally and externally, has been given the highest finish throughout. Trials have been run during which a mean speed of 12½ miles per hour was attained, which, considering the ample beam of the vessel and the load carried, was considered highly satisfactory.



MOTOR YACHT SWIETLANA.



ENGINES OF MOTOR YACHT SWIETLANA.

TRADE NOTES.

The National Brake & Electric Co., Milwaukee, Wis., have just put out a bulletin descriptive of National type "3 V S" air compressors. These compressors are of the single-stage, motor-driven type, and are especially adapted for railroad, mining and general industrial work.

Hollis Burgess, 10 Fremont street, Boston, Mass., has made connection with the Boston Insurance Co. for handling yacht and automobile insurance. His yacht brokerage business will be conducted hereafter at 15 Exchange street, where he has associated himself with Walter Burgess under the name of the Hollis Burgess Yacht Agency.

The Crescent Machine Co., Leetonia, O., report that their business is very near to the aggregate monthly business for 1907. The company finds it necessary to operate the factory full time in order to keep up with deliveries. This is highly complimentary to the quality of its machines.

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CHICAGO FIRE BOATS

From the designs of W. I. Babcock, engineer and naval architect, of 17 State street, New York, two fire boats for the fire department of the city of Chicago are now being built by the Manitowoc Dry Dock Co., of Manitowoc, Wis., and it is expected that they will be completed and go into service by the middle of this summer. We have the pleasure of presenting plans and description of these boats herewith.

HULLS.

The boats are 120 ft. over all, 109 ft. 6 in. between perpendiculars, 28 ft. molded beam, 15 ft. molded depth and will have a draught of about 9 ft. 6 in. They are constructed of steel throughout, practically no wood being used anywhere except for the inside finish of the deck house and pilot house. The fore foot is cut away considerably, both for convenience in handling and for breaking ice, and the bows at the water line are heavily strengthened also for the latter purpose. There are five bulkheads, of which four are watertight, and lower decks forward and aft, dividing the hull into six watertight compartments.

With the exception of the engine room skylight, the low boiler trunk and a deck house immediately forward of it containing a toilet room and large hose room, with pilot house on top, the deck is flush. A plate bulwark forward continues back to the deck house, from which an open iron rail extends aft supported by cast steel stanchions. Two lines of heavy iron trough-shaped fenders run all fore and aft on the outside of the hull.

SPUDS.

The Chicago river, where these boats will be used, is in many places 200 or more feet wide and the buildings extend right to the water's edge. The depth is about 20 ft. Since the opening of the drainage canal to the Mississippi there is at all times a considerable current in portions of the river. In order, therefore, to hold the boats in a position where they can do effective work on a fire at the river bank, where lines can not be made fast to moor them, they are fitted with spuds like a dredge, two forward and one aft, working through wells in the bottom of the boat, and raised and lowered by steam power. These spuds are made of double thick steel pipe, 18 in. diameter, stiffened internally by heavy plates and angles, shod with cast steel points to take hold of the river bottom, and made watertight to reduce the apparent weight to be handled.

For facility in maneuvering in the narrow and crooked river and in the slips where the boats have to work, they are fitted with twin screws and also with steam steering gear. By working one screw ahead and the other astern, the boats can be swung completely around as on a pivot in either direction.

MACHINERY.

The arrangement of the machinery on these boats is novel in that the same engines are used for operating the fire pumps and propelling the vessel, thus entirely doing away with separate propelling engines. Each boat is fitted with two centrifugal fire pumps, built by the I. P. Morris Co., of Philadelphia, of the two-stage type with 14-in. suction and discharge, and capable of delivering together 9,000 gallons of water per minute at a pressure of 150 lbs. per sq. in. when running at a speed of 1,700 R. P. M. By branch pipes properly fitted, the discharge of one pump can be turned into the suction of the other, thereby running the pumps in tandem as one four-stage pump, then delivering 4,500 gallons per minute at 300 lbs. pressure. This, going through a 3½-in. nozzle, will make a tremendously powerful and effective stream.

At 125 lbs. pressure, these pumps will each deliver 5,500 gallons per minute. One of the great advantages of the centrifugal pump for this service is that the volume and capacity can be varied at will. Combined with this is a smoothness of operation and lack of necessity for attention not found in any other pump, while if inadvertently all discharge openings are closed at once, the pressure would rise but slightly and there would be no danger of bursting hose or anything else. Another great advantage of centrifugal pumps operated by steam turbines is in the fact that the boat can throw her rated capacity of water at all times and also in the great saving of fuel over the ordinary reciprocating pumps, operated with single non-condensing steam cylinders. The water consumption of the turbine per horsepower per hour is only about 27 lbs., whereas, with the reciprocating pump it is doubtless at least three times that amount. It is practically impossible to put boilers enough in the boat to supply this amount of steam. Even with the exhaust turned into the stack to force the draft, which means a low efficiency for the boilers, there is probably no fire boat in service today with reciprocating pumps that can run those pumps to anywhere near their full capacity. A boat rated as of 9,000 gallons capacity per minute is really only about a 6,000-gallon boat.

The pumps are set one on each side of the ship, drawing from a 14-in. header, extending across the engine room immediately forward of them, and delivering to turrets on deck directly above. All connections are short and direct and all curves of easy sweep. The deck turrets are set diagonally on deck and each has nine 3½-in openings for hose with quick moving lever valves at a convenient height. In winter these turrets will be enclosed in iron casings to which steam pipes are lead to prevent freezing. At a height of about 7 ft. above the turrets is an oval platform carrying the two 3½-in. universal monitors, which are vertically over the turrets and supplied by 5-in. pipes from them. The supports for the platform and the ladder to it come between the turrets so as not to interfere with the hose lines. There are no other monitors on the boats, Marshal Horan, of Chicago, believing that smaller ones forward and aft are unnecessary.

Each fire pump is driven by a horizontal Curtis turbine of 660 H. P., built by the General Electric Co., of Schenectady, N. Y., and directly-connected to it on the same shaft and bed plate. This shaft also carries a 200-K. W. generator of the direct-current type, shunt wound for 275 volts, for operating the propelling motors. On each of the propeller shafts of the vessel is placed a direct current, variable speed, reversing motor, shunt wound and designed for operating on the variable voltage system, developing 250 H. P. at 200 revolutions.

Two turbo-generator exciting and lighting sets of 25 K. W. capacity each are provided, either of which alone is sufficient.

All generators and motors are to be tested by a stream of water from a hose and must operate perfectly under such conditions. Steam or moisture in the engine room will, therefore, have no effect on them.

The generators and motors are supplied with independent controllers, two in the engine room and two in the pilot house with suitable switching devices so that only one set can be in use at a time. A switchboard is installed in the engine room. Between the two turbine sets, high up under the deck beams to save floor space is a surface condenser built by the Alberger Condenser Co., of New York, with wet and dry vacuum pumps directly beneath it. The 10-in. centrifugal circulating pump is on the port side abaft the turbine set. The capacity of this pump is 3,000 gallons per minute and it is fitted with a bilge suction so

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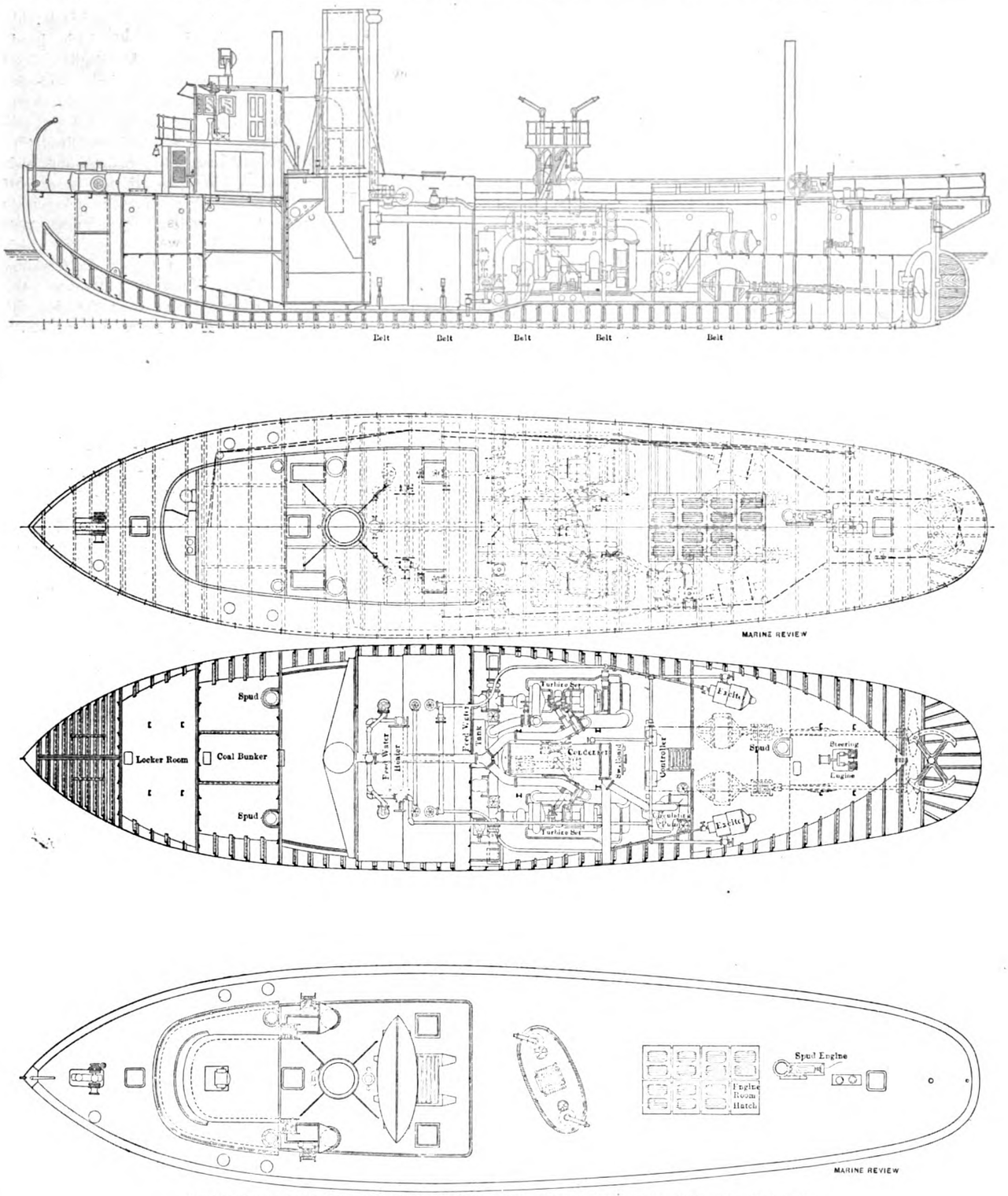
that it can be used for pumping out the engine room in case of necessity. Feed and pony pumps, sanitary pump, etc., are a compartment next forward of the engine room, placed side by side facing forward. These boilers are 12 ft. 6 in. in have one stack in common and are operated on the closed stokehold system, the blower being in the engine room.



SECTIONAL PLANS OF THE MOTOR-DRIVEN FIRE BOATS FOR THE CITY OF CHICAGO.

placed on the bulkhead next the boiler room.

BOILERS.

There are two Scotch boilers, built by Johnston Bros., of Ferrysburg, Mich., in diameter and 11 ft. 6 in. long between heads, built for a working pressure of 170 lbs. In each boiler are two Morrison furnaces, 44 in. diameter, with separate combustion chambers. The boilers

OPERATION.

In the operation of these boats, great speed is not required and, therefore, the generators and propelling motors are only of moderate power, less than one-

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half the capacity of the two turbines. The Chicago river is crossed by bridges every block or two, which must be opened for the passage of the boats, so that high speed is out of the question. It was considered further that a combination of circumstances requiring full power on the fire pumps and full power on the propelling motors at the same time for any protracted period is practically impossible, and that if, while the boat is pumping water to her full capacity, the motors are called into service to change her position slightly, the turbines will easily stand the temporary overload. It was for this reason that the electric propulsion was decided upon. The turbines were there anyway for the fire pumps. If ordinary steam engines were used for propelling the boat, it meant two more engines with four cylinders, valves, shafts, rods and all the complication and working parts to take care of and keep in repair. Adding the generators and motors, which practically require no attention at all, added nothing to the work of the engineer, while by the system of control adopted, he is even relieved of the necessity of answering bells and operating engines as usual. All this is done from the pilot house where the captain has a lever under each hand and can control his twin screws, going ahead or back on either or both at any speed instantaneously and entirely independent of the engineer, to whom it makes no difference whether the motors are turning or not. When the boat is lying at her station, under banked fires, waiting for an alarm, the sea cocks are closed and the pumps drained of water. When an alarm comes in, the engineer has only to start his turbines, circulating and air pumps. The captain starts the propelling motors and on the run to the fire, the power of the turbines is used for running the boat only, the impellers of the fire pumps turning freely in the casings and doing no work. Special arrangements are fitted for oiling the bearings under this condition. On arrival at the fire, all the engineer has to do is, without stopping the turbines, to open the sea cocks and turn water into the pumps. As soon as the propelling motors stop, the generators cease to develop power, and the armatures turn freely, the power of the turbines then being used for pumping only. If the motors are called upon temporarily to shift the position of the boat, the action of the pumps is not interfered with.

When the fire is over and the boat relieved, the engineer simply shuts his sea cocks, opens the drains on the pumps and the boat goes back to her station.

There are important incidental advantages in driving the screws by motors instead of steam engines. One is that if the boat ever has to go into rough water there is no racing of the screws, the speed of revolution being constant for whatever voltage is being used, which is governed by the controller. It is also possible for short periods to considerably increase the revolutions and power developed by the motors though this can not be done for any length of time on account of undue heating. Another advantage is that if a sudden strain is put upon the shaft, by the propeller striking heavy ice or against dock piles or other obstructions which are frequently encountered in the confined spaces in which the boats must work, the circuit breaker throws out, instantly taking off the power, and there is much less danger of breaking wheels or shafts than if a steam engine were used.

The engineer has to answer no bells at any time and can devote his whole attention to his machinery. Of this, the turbines and fire pumps are entirely enclosed and require no attention at all, while at this day nothing is more reliable than high class generators and motors or requires less attention.

As an additonal precaution, the extra controllers are fitted in the engine room and the engineer can operate the motors on signals from the pilot house as usual, if desired.

A full installation of electric lights is installed, operated by either one of the turbine exciting sets, and a powerful searchlight is fitted on top of the pilot house.

BREAKDOWNS.

These boats are exceptionally guarded against total disablement by break downs to any single part of the equipment. Nearly everything is in duplicate. There are two boilers, two fire pumps, two turbines, two generators, two screws, two propelling motors, two exciting and lighting sets, two feed pumps and two injectors. While there is naturally only one condenser, circulating and air pump, the turbines are fitted with disabling pipes through which they can be exhausted to the atmosphere if necessary, so that any accident which puts the condenser temporarily out of service can only reduce somewhat the efficiency of the boats without causing them to be laid up entirely.

The people of the Hawaiian Islands are subscribing to a fund for the yacht Hawaii which is to be entered in the trans-Pacific yacht race scheduled to sail from San Pedro next June.

The floating dry dock constructed at the Weaver ship yard, Orange, Texas, for the New Orleans Ship Building & Dry Dock Co., left on its journey to New Orleans last week.

ADMIRAL EVANS' REPLY.

Secretary of the Navy Metcalf last week made public the views of Admiral Evans regarding the proper location of the armor belt on battleships. The admiral wrote his report while en route to the Pacific with his squadron. He says:

"Judging from the figures contained in the several replies from commanding officers which relate to the subject of armor belts it would appear that better protection might have been afforded had those belts been originally placed between 6 in. and 1 ft. higher; this on the theory that the commanding officer would admit sufficient water before an action to sink the belt to within about 18 in. above the water line.

"But even this is open to question, for it has been noted that even when heavily laden and in the smooth to moderate seas, which have thus far characterized this cruise, the ships frequently expose their entire belt and the bottom plating beneath.

"It must be remembered that even a 5 or a 6-in. shell, of which there would be a great number, could inflict a severe and dangerous injury if it struck below the belt, while otherwise the water line, even with the belt entirely submerged, is, on account of the casemate armor and coal, immune to all except the heaviest projectiles.

"The fact is that under the sea conditions in which battles may be fought a belt of 8 ft. in width, if considered alone, is too narrow to afford the desired protection wherever it may be placed, and the question becomes an academic discussion with certain arguments on each side.

"It is understood that on the latest ships this question is of little import, as the citadel armor is but 1 in. less in thickness than that on the water line, and for those ships already built it is believed that when the bridges are removed and all weights, which would be landed should war break out, are taken into consideration, the ship will rise to the 6 to 12 in., which is believed to be the maximum that it could be desired to raise them."

The report of Admiral Evans is made in accordance with instructions given him by Secretary Metcalf before he sailed from Hampton Roads. The secretary said it had no reference whatever to the criticisms of naval construction which have appeared since the sailing of the fleet.

Navigation between Buffalo and Cleveland will open on April 15 if ice conditions at Buffalo permit it.

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ATLANTIC COAST GOSSIP.

Office of the MARINE REVIEW,
Room 1005, No. 90 West St.,
New York City.

After a New York paper had gone to the trouble of announcing at some length that gentle spring had arrived on the north Atlantic, and that "multitudes of Americans intending to cross the Atlantic this spring will be interested in the reports of steamers recently arriving at this port from Europe," it was certainly too bad that the big Mauretania should arrive last Saturday and report considerable damage done to her deck and bridge fittings during unusually heavy weather which continued most of the trip. Other incoming liners told a like tale.

The North Atlantic always was a perverse old critter, anyhow.

The department of commerce and labor at Washington has issued instructions to the immigration authorities at Ellis island that on Jan. 1, 1909, all vessels carrying immigrants to America will be inspected for licenses on the British plan of allowing so many superficial feet for each man, woman, and child, and, in addition, 5 ft. of superficial deck space for each immigrant.

The Mauretania of the Cunard line, sailed on Wednesday for Europe, inaugurating the Cunard semi-weekly service. Hitherto the Mauretania sailed on Saturdays, but on this occasion her stay in port was of only four days' duration.

The Wednesday and Saturday sailings will be maintained with the Mauretania, Lusitania, Caronia, Carmania, Campania, Lucania, Umbria and Etruria.

The change in the naval flags due to the addition of one star through the advent of Oklahoma to the union has been provided for in orders issued by Secretary Metcalf. On July 4 the flags will contain 46 stars, arranged in six rows.

The Norwegian bark Inglewood, bound from New York for Stockholm with a cargo of naphtha, caught fire and exploded at Mandal, where she arrived on March 20, killing 13 of her crew.

The Japanese steamship Buyo Maru, which loaded 2,000,000 gallons of refined petroleum in bulk at Philadelphia last week, has sailed for Madras and Calcutta with a crew composed of two Englishmen, 15 Chinese, and the remainder Japanese.

The senate has passed a house bill which substantially benefits employes of the United States life-saving service. Superintendents of the 1st, 2d, 4th, 5th, 6th, 7th, 10th, 11th, 12th and 13th districts will receive a salary of $2,200 a year, of the 3d and 9th districts, $2,000, and of the 8th district, $1,900. Keepers of life-saving stations are to receive $1,900, and the pay of a No. 1 surfman will be $70 per month. The bill also provides a pension for two years for the dependent relatives of any keeper or member of a crew who may die by reason of perilous service or injury received in the line of duty, the pension to equal the full amount the life-saver would have received during the same period.

The British schooner Baden Powell has been wrecked on the southern coast of Newfoundland, all the members of the crew being saved. The Baden Powell was bringing a cargo of molasses from Barbadoes, and on reaching St. Marys bay encountered a heavy gale. After all her sails were gone the schooner was driven ashore.

Business and hotel men of Atlantic City, N. J., will hold a meeting at that place in May to discuss the jettying of the inlet for securing of deeper channels. Major Flagler, chief of federal engineers, has notified Mayor Stoy that he will be present at that time to hear argument for the project. The city proposes to spend $500,000 in making a harbor for deep sea vessels and big yachts, and men back of the movement believe they can convince the officers that the work is both necessary and without danger as far as obstructing navigation is concerned.

The steamers of the People's night line service between New York and Albany will resume navigation on the Hudson river this week for the season. During the winter months the steamers of the line have been completely overhauled and prepared for the passenger season.

The Joy line pier on East river, New York, was completely destroyed by fire on Monday morning. The steamers Larchmont and Oregon had to be cut adrift and taken down the stream until they could be moored temporarily at another pier, the Edgemont, also of the Joy line, being all ablaze on one side before she was cut loose. A number of the firemen fighting the flames were overcome, three of them being seriously injured. The damage is estimated at $150,000.

Before the government can proceed with the contemplated $250,000 improvement of the Battery, New York harbor, consisting of the erection of a four-story stone building back of the barge office, they will have to overcome the opposition, it is said, of the Battery boatmen to the government acquisition of the 40-ft. basin to the west of the barge office bulkhead, used by the boatmen as an anchorage.

The British steamship Manchester Trader, from Manchester for Philadelphia, has been towed into Fayal, Azore Islands, by the British steamer Armenian, from Liverpool for New York. The Manchester Trader broke her tail shaft and lost her propeller and was in an absolutely helpless condition when picked up by the Armenian. She has a general cargo consigned to Charles M. Taylor's Sons, agents of the Philadelphia-Manchester line. As there are no facilities at the Azores for extensive ship repairs the disabled vessel may have to be towed back to Liverpool.

Chief Engineer Curry, of the Mauretania, had his hand injured by a door soon after the vessel left Liverpool this voyage. He was put ashore at Queenstown. Fourth Officer Wingate was cut about the face by broken glass later in the voyage, when a huge wave smashed several ports of the navigating room.

Capt. Thomas H. Barrett, for 25 years inspector of steam vessels for the port of New York, died in Yonkers last Saturday. He was 74 years old.

Capt. Barrett served on the City of Peking during the Civil war. He was a member of the Loyal Legion, army and navy clubs, and the Farragut Association.

A special room was recently erected, temporarily, on the deck of a Savannah liner, for a passenger who was a fresh air faddist.

Fire broke out Friday night on the steamer Indian, at Boston. It originated beneath the pilot house, where the crew could not extinguish it. The city fire department did the trick, however, and the damage done amounted to but a few hundred dollars.

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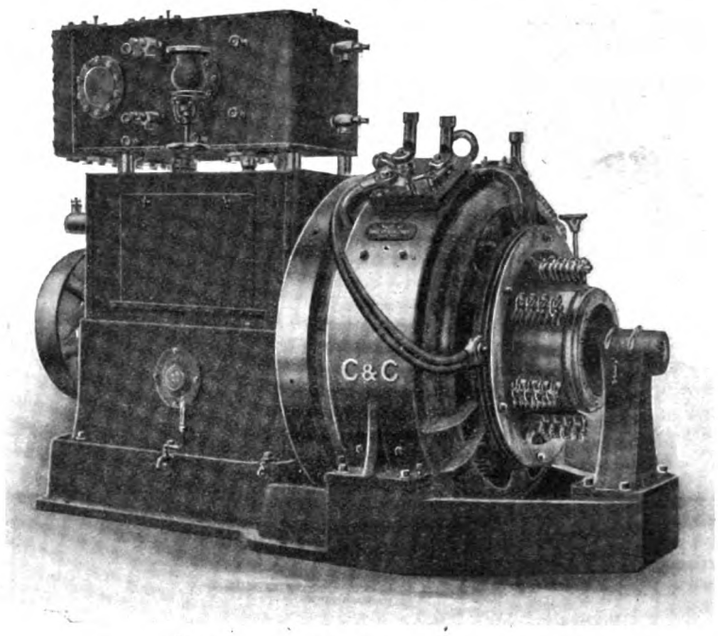
GENERATING SETS.

The accompanying illustrations show three types of generating sets manufactured for marine installation by the C. & C. Electric Co., close attention to requirements aboard ship and considerable experience in dynamo construction having enabled the makers to produce machines which for reliability and compactness are particularly well adapted for use on yachts, ferries or the larger class of vessel. These machines are known as types "A," "C" and "F," the driving engines being manufactured by the American Blower Co., the New Britain Machine Co. and the W. D. Forbes Co., respectively, and comprise three distinct lines made in sizes giving a total range of output of from 1½ kilowatts to 100 kilowatts, and up to 500 volts.

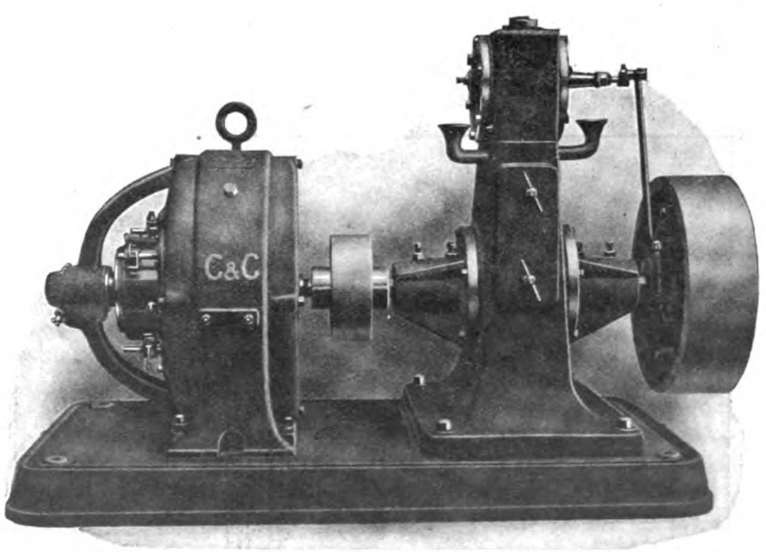


"M.P.L." GENERATOR DIRECT-CONNECTED TO A FORBES TWO-CYLINDER, VERTICAL-COMPOUND MARINE ENGINE INSTALLED ON BATTLESHIP INDIANA.

Series "A" sets are made in sizes to give outputs varying from 4 kilowatts to 80 kilowatts, and are made up of various sizes of dynamos direct-connected to the engines, the whole being mounted on a substantial base. These dynamos are of the four-pole type and are equipped with armatures of the hollow-drum iron-clad type which, owing to their novel construction, show little rise in temperature when the machine is in operation. The soft sheet steel laminae are thoroughly insulated by oxidation and are so punched that there are three horse-shoe-shaped ducts running parallel with the shaft the entire length of the armature, air being drawn through when the armature is revolving, with remarkably cooling effect. The engine is of the piston valve type, double-acting, enclosed and self-oiling, and is built for high speeds. Regulation is effected by means of the Rites Carpenter fly-wheel governor, and the automatic internal lubrication by gravity flow to all parts with pump return.

Series "C" sets, the output of which range from 1½ kilowatts to 20 kilowatts, are equipped with the C. & C. "S.L." dynamo, which, though of comparatively recent introduction, having been brought out during 1904, has already become very favorably known. The commutator of the "S.L." dynamo is of unusual width and diameter, having the segments of the best hard-drawn copper of a depth assuring long wear, while their length permits "staggering" of the brushes to secure uniform wear. The shell is carried on a spider, the spokes of which are formed as vanes resulting in perfect ventilation. These machines are furnished enclosed, semi-enclosed or entirely open, according to specifications.

Series "F" sets are equipped with two different types of dynamos, the "S.L." and "M.P.L.," the former being used for the small sets and the latter for the larger output. Series "F" sets are made in sizes to give outputs ranging from 3 kilowatts to 100 kilowatts. Both of these types of dynamos are suitable for all classes of light and power production. The "M.P.L." magnet frame and pole pieces are cast of a special grade of soft steel, the frame being of two semi-circular parts bolted together and having the pole pieces bolted thereto. The field coils are wound with insulated copper wire or strips upon insulated metal bobbins and are readily removed from the pole pieces. The armature spider is of cast iron having the spokes elliptical in section, while the hub is in the form of a long sleeve upon one end of which is mounted the commutator. Thus the entire armature with commutator is carried on a single, having unusual length of bearing on the shaft, to which it is securely keyed. The armature body is composed of thin sheet steel segments, insulated and keyed to the spider. The periphery of the body contains slots insulated to receive the form wound coils which are themselves separately and thoroughly insulated before being placed in the slots. The brush holders are the "M.P.L." reaction type, in which recent improvements have been made. With these holders firm contact is maintained between commutator and brush. For this



"S.L." GENERATOR DIRECT-CONNECTED TO CASE ENGINE.

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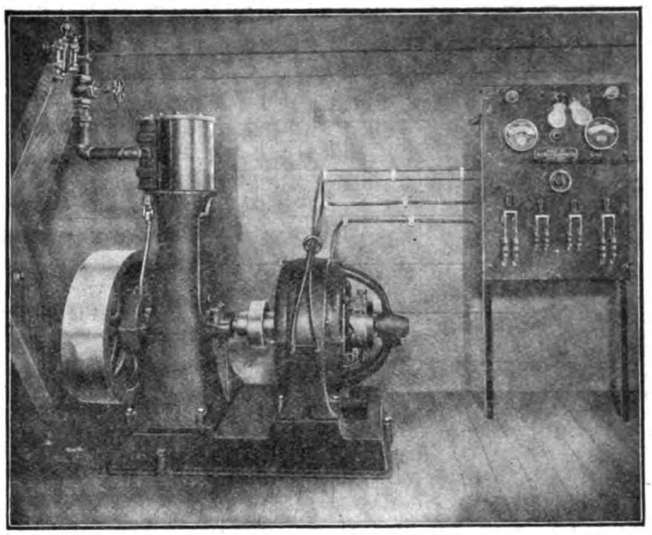


"S.L." GENERATOR DIRECT-CONNECTED TO AMERICAN BLOWER ENGINE.

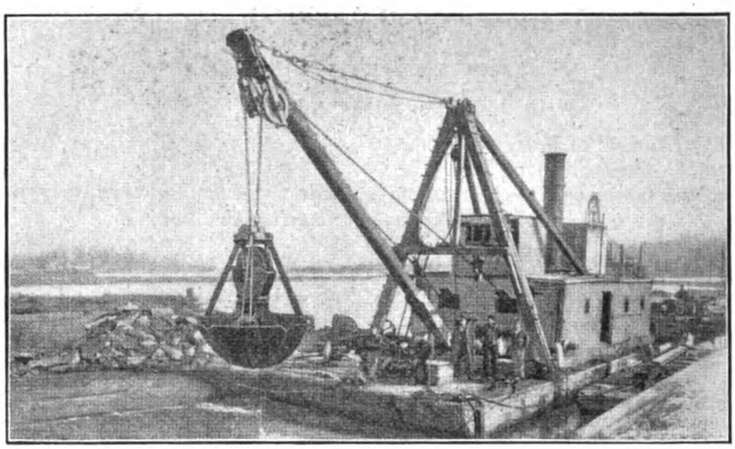
line the Forbes engine is exclusively used, being a high-speed, automatic, double-acting engine of plug-valve type, with sight-feed lubrication, uniform speed being assured by use of the Rites governor.

The main office and works of the C. & C. Electric Co. are at Garwood, N. J., the New York office being at 149 Broadway.

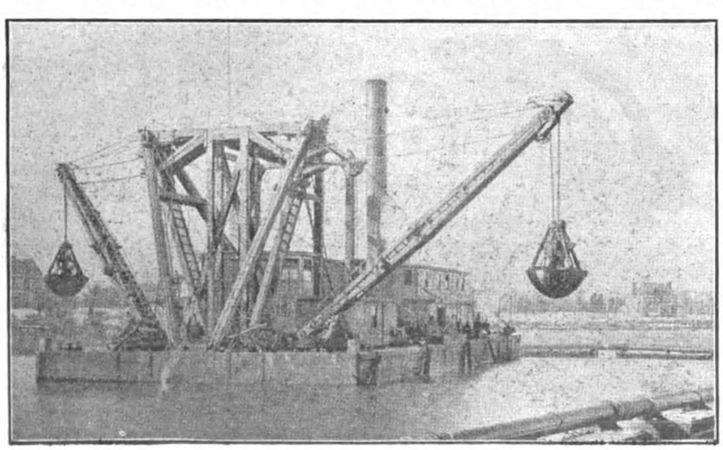
BUCKET OPERATING DREDGE.

The dredges shown in the accompanying illustrations are two of the many types of bucket-operating dredges in use wherever extensive harbor construction or river improvement operations are being carried out. The double dredge has been designed and built for canal construction, and is equipped with two buckets, two booms and two vacuum pumps. The capacity of this machine is from 8,000 to 10,000 cubic yards per day of 10 hours, depending upon the material and depth of cutting, the buckets and booms having independent hoisting and swinging engines enabling them to be used together or separately, as may be desired. The dredged material is discharged into hoppers located in and on both sides of the scow, from whence it is taken up by the vacuum pumps and discharged through pipes to the spoil tank or other waste place, at any point up to 3,000 ft. Machines of this description, and smaller capacity, are used for reclaiming swamp lands, river dredging, etc., one machine, owned by the Norfolk Dredging Co., having recently been engaged in deepening channels, digging canals, filling in behind bulkheads and general dredging purposes, in addition to filling cars.

The dredge shown in our other illustration is owned by Messrs. John and Joseph McSpirit, of Jersey City, and has been used principally in removing blasted rock from under water. At New Brunswick, N. J., rocks weighing between six and seven tons were handled by this machine without injury to the bucket. It operates a 1½ cubic yard orange peel bucket, and during the excavations at New Brunswick varied in capacity from 300 to 500 cubic yards per day of 10 hours.



REMOVING BLASTED ROCK FROM UNDER WATER.



DOUBLE DREDGE ON CANAL CONSTRUCTION.

The uses to which the bucket-operating dredge can be put are innumerable. In the west, where the rise and fall of the rivers and sloping banks make conditions differ greatly from the east, these dredges have been found the most practical devices for handling coal, the coal being transferred by the machine to a hopper, which in turn loads cars that carry the coal to the storage. For western and southern river dredging it has been found necessary, in many cases, to design special shallow draught dredges, as a deep draught dredge would be practically useless. For handling sand or gravel, coal or rocks, the bucket-operating dredge has no equal.

The Hayward Co., New York, have equipped the dredges illustrated, being manufacturers of dredging and excavating machinery. Their well-known orange-peel and clam shell buckets are especially adapted for digging and dredging operations.

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THORNYCROFT PARAFFINE MOTORS FOR THE ITALIAN NAVY.

The Italian government is building several twin-screw submarine torpedo boats, two of which are of special interest because they are being fitted with what it is believed, are the largest engines using petroleum as fuel which have up to the present time been built for marine purposes. The displacement of these vessels when cruising will be 150 tons, and when submerged, 220 tons. Their length will be 98 ft. 4 in., and the breadth 13 ft. 9 in. and they are intended to have a cruising speed of 14 knots, the speed submerged being 8 knots. The cruising range will be 2,000 miles. The engines have been provided by Messrs. J. I. Thornycroft & Co., Ltd., of Chiswick, and are constructed in four-cylinder units, bolted together, making eight cylinders on each shaft. The dimensions of the cylinders are 12 in. diameter by 8 in. stroke.

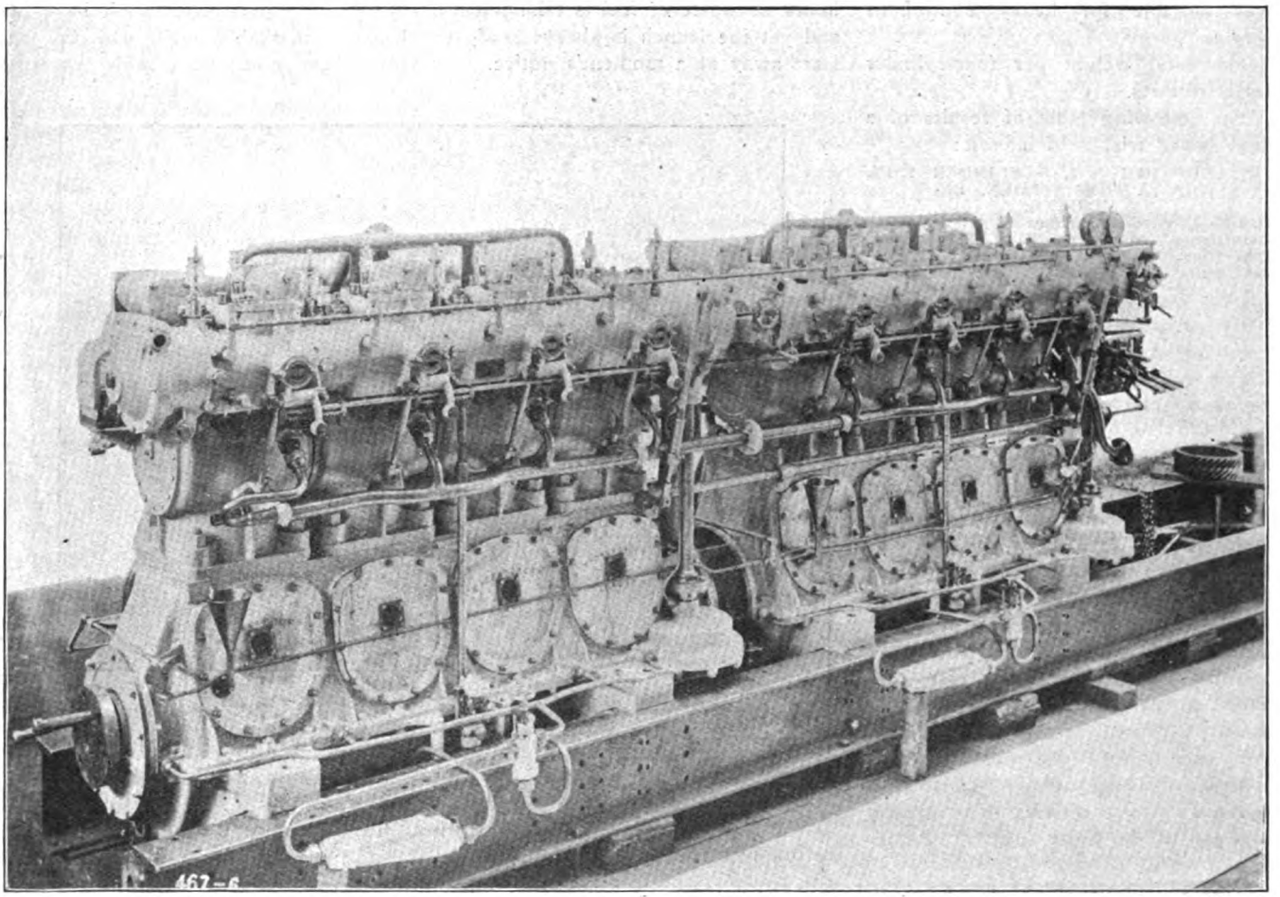
They are totally enclosed and lubrication is forced to all bearings—those on the crankshaft, and also the bottom of the crankcase, being water-cooled.

In addition to this, the pistons and crankcase generally are continuously cooled by sucking cold air which is drawn through by an exhausting fan.

Facilities are provided for the removal and replacement of the pistons and connecting rods through the doors in front of the engine, thus rendering removal of the cylinders and access from the back of the motor unnecessary—an advantageous feature for submarine boats.

Cooling water is circulated by a separately driven centrifugal pump, driven by either an electric motor, or a small oil motor using the same fuel as the main engine. A great advantage of this method is that the motor may be cooled more rapidly after running, in case examination or adjustment become necessary. The separate drive aso allows of a close regulation of the quantity of water to suit the needs of the engine, according to the nature of fuel used.

The special paraffine vaporizer is fitted with a variable exhaust by-pass so that the temperature may be exactly graduated to the needs of the particular fuel used. This is very essential as the oils used for fuel vary so greatly in the amount of heat required to vaporize them, and excess of heat is as harmful as too little. With a proper regulation of the heat the engine or vaporizer never requires to be cleaned as there is no tar deposit. Trouble on this score is absolutely non-existent with these engines.



PARAFFINE MOTOR FOR ITALIAN NAVY.

An entirely novel feature is the reversing mechanism. Instead of the usual method of using a double set of cams for running in either direction, the cam shaft is so arranged that, whichever direction the engine itself runs, the cam-shaft turns in one direction only, and to provide for this a reversible bevel drive, with positive clutches, is fitted.

Starting in either direction is effected by means of compressed air, the valves controlling which are cut off immediately the engine is firing.

Low-tension magneto ignition and distributor are fitted in conjunction

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with a special form of make and break gear in the cylinders.

The consumption of fuel is very low, being about 0.7 pint of paraffine or petrol per brake horse power per hour.

The engines are designed with ample bearing surfaces, and are in every way suitable for heavy continuous service.

The total weight per four-cylinder set is 70 cwts.

The following table of results of a three hours' trial is of interest:

TRIAL OF F4/1 & 2, 8-CYLINDER 12-IN. DIA. X 8-IN. STROKE, REVERSING.

Fuel used, Phoebus Paraffine S. G., .820.
Consumption, .66 pint per B. H. P. per hour.

Time from start, hours	B. H. P.	Revs.
0	324	550
¼	328	555
1	340	590
1¼	327	595 ..
2	318	595
2¼	318	600..
3	324	600

Average revs. per minute, 582.5
Average power, 325.5 B. H. P.

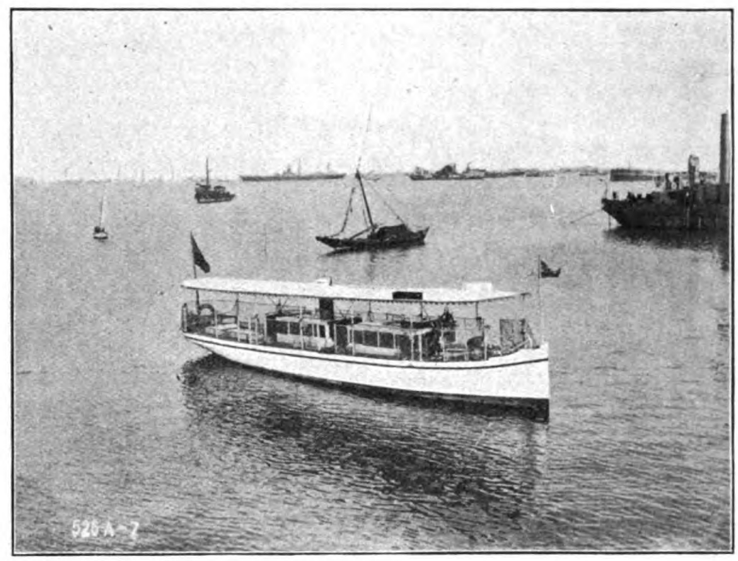
MOTOR BOATS FOR INDIAN CUSTOMS SERVICES.

Among the numerous uses to which motor boats have been put perhaps the service in which they appear to the greatest advantage, and in which they show the highest degree of superiority over steam, is in harbor or customs service where the vessels are likely to be required for immediate use at any hour of the day or night. For such duties the capacity they possess of being able to start at a moment's notice renders them greatly superior to the older form of propulsion.

Messrs. Thornycroft & Co., of Chiswick, are receiving a good share of orders for this work, and have supplied motors or boats for such services to many parts of the world, including Holland, Portuguese, India, China, Chili, Russia, etc., in addition to those in use at home ports.

As typical examples of customs requirements in one of the busiest harbors of the world may be instanced the two launches which the Bombay customs have had in use for the past nine months. They were built in India at the government dockyard, Bombay, and fitted with Thorycroft motors out there under the supervision of a representative of Messrs. Thornycroft's yard. The work had previously been carried out by two single-cylinder steam-engined boats, but these had become inefficient for the work required.

Such services acknowledge no limit of working hours, and with the old launches there was always the difficulty to be faced of either keeping the fires going or having to get up steam against time. When new vessels were considered the inherent advantage in this respect of the Thornycroft motor was put forward as a great point in its favor. A vessel thus fitted may lie at anchor with the engine stopped. If the boat is not required for several hours no waste of fuel is taking place, and yet the launch is always ready to start away at a moment's notice.



MOTOR BOATS FOR INDIAN CUSTOMS SERVICE.

In drawing up the designs, local conditions were taken into consideration. During the monsoon season the work in Bombay harbor is not unattended with danger; speed is also an important factor, however, and therefore the forward lines of a torpedo boat were adopted. Thus the launches are able not only to cut easily through the water, but are thoroughly "dry."

As they are often out at night, snug quarters are fitted in the shape of a roomy cabin amidships behind the engine room, while a large well aft affords equal comfort in the open air when that is preferred.

The length of the two launches is 56 ft. overall with a beam of 10 ft. 6 in. The draught ranges from 2 ft. 6 in. forward to 3 ft. 6 in. aft. Amidships there is 3 ft. of free board but this is gradually increased until the bows give about 5 ft. and this is found sufficient to raise the vessel above any wave.

Forward is a fair sized watertight bulkhead behind which comes the crews' quarters, and then the engine room.

The engines are of the Thornycroft "D4" type, having four cylinders each, 8 in. bore by 8 in. stroke, and developing 100 B. H. P. on petrol at about 800 R. P. M., or about 80 on paraffine. The engines are identical in both launches, but one is started by compressed air and the other by hand.

The launches are named "Ella" and "Evelyn" respectively. Both have behaved remarkably well, and the engines have given no trouble whatever though in continuous use day and night.

The Bombay port authorities have also another launch, the "Amina," fitted with a Thornycroft engine. This is a smaller boat than the two above mentioned, and the power is supplied by a 50-B. H. P. paraffine launch.

In addition to the three vessels at Bombay, the Madras harbor authorities also possess a customs boat fitted with a Thornycroft 100-B. H. P. motor, which is also doing exceedingly well.

The steamer Nan Smith, built by the Newport News Ship Building & Dry Dock Co., Newport News, Va., under the direction of Horace See, naval architect for the C. A. Smith Timber Co., arrived at San Francisco on March 12 or 67 days after leaving the Chesapeake, the only stop being made at Magdalena bay on account of a broken propeller blade. The steamer however, proceeded to its destination without making repairs.

The North German Lloyd Steamship Co. has declared an annual dividend of 4½ per cent as against 8½ per cent paid last year.

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		ALGOMA CENTRAL STEAMSHIP LINE, SAULT STE. MARIE, ONT.	
Str.	Agawa	W. C. Jordan	J. L. Smith
"	Leafield	F. J. Davis	James Cameron
"	Paliki	R. H. Boyle	William Harman
Sch.	John J. Barlum	Charles Staley	
Str.	King Edward	William Bemrose	George Sylvester
		J. E. BALL, MGR. THE MILLER S. S. CO., BUFFALO, N. Y.	
Str.	P. P. Miller	Frank Weinheimer	W. C. McDougall
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Str.	Pere Marquette 5	Thomas Bavey	Charles Grobben
"	Wisconsin	Joseph Lamoreaux	Joseph Warner
		GEORGE F. BELL, TOLEDO, O., MGR. SANDUSKY LUMBER & BOX CO.	
Sch.	Charles Wall	Andrew Haganey	
		C. F. BIELMAN, DETROIT, MICH.	
Str.	C. F. Bielman Jr.	John G. Ivers	William Garardo
		John S. Riggs	Joseph Rosseau
		W. S. BRAINARD, TOLEDO, O.	
Str.	Cherokee	James Mara	John S. Robertson
Sch.	Chippewa	John McKeigan	
		BROWN & CO., MGRS., BUFFALO, N. Y.	
Str.	J. J. H. Brown	F. D. Chamberlin	Peter Collins
"	William H. Truesdale	George C. Stevenson	George Bartley
		BROWN STEAMSHIP CO., CLEVELAND, O.	
Str.	Castalia	John F. Jones	Edward Dempsey
		J. A. CALBICK CO., 2 SHERMAN STREET, CHICAGO, ILL.	
Str.	P. J. Ralph	John Evans	J. T. Mellor
"	Walter Vail	Robert T. Evans	J. McMillan
"	J. H. Prentice	Samuel Olson	———
"	Kalkaska	Gust Gunderson	———
Bge.	Harold	Harry Hagenson	
"	Connelly Bros.	Carl Johnson	
"	Halsted	John Lundberg	
"	R. L. Fryer	Emil Christen	
		THE CALVIN CO., LTD., GARDEN ISLAND, ONT.	
Str.	Simla	P. Sullivan	Robert Veech
"	India	Charles Coons	Thomas C. Smith
"	D. D. Calvin	George Houston	George Boyd
Sch.	Burma	J. Ferguson	
"	Ceylon	F. Lawrence	
		CANADA ATLANTIC TRANSIT CO., MONTREAL, CAN.	
Str.	George N. Orr	Herman Jaenke	John Murnan
"	Arthur Orr	John Simons	George M. Larson
"	Kearsarge	William Baxter	Thomas Kelley
"	Ottawa	Alex Birnie	William Paus
		CANADIAN LAKE & OCEAN NAVIGATION CO., LTD., TORONTO, ONT.	
Str.	Scottish Hero	Peter McIntyre	R. R. Foote
"	Turret Cape	R. D. Simpson	P. Bonham
"	Turret Court	Robert McIntyre	L. McMillan
"	Turret Chief	H. Boult	A. E. Kennedy
"	A. E. Ames	A. McIntyre	S. Gillespie
"	J. H. Plummer	Win McLean	R. Chalmers
"	H. M. Pellatt	W. H. Anderson	W. H. Durham
		THE CANADIAN LAKE TRANSPORTATION CO., LTD., TORONTO, ONT.	
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"	Regina	Peter McKay	C. J. McSorley
"	Corunna	William Brian	R. Ross
"	Nevada	J. Cavanagh	W. Linton
		CANADIAN PACIFIC RAILWAY CO., OWEN SOUND, ONT.	
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		E. T. CARRINGTON, BAY CITY, MICH.	
Bge.	Allegheny	W. H. Bridges	
		CLEVELAND TRANSPORTATION CO., CLEVELAND, O.	
Str.	E. A. Shores Jr.	George F. Sauer	———
		COLLINGWOOD SHIPPING CO., LTD., COLLINGWOOD, ONT.	
Str.	Wasaga	M. McKay	John Myler

POWER BOAT FOR LIFE SAVING SERVICE.

The first six-cylinder gasoline power boat for the United States Life Saving Service, which is to be stationed at Waaddah island, just inside of Cape Flattery, the north-west point of the United States, near the scene of the Valencia wreck of years ago, has just been shipped to Seattle, Wash., by the Holmes Motor Co., of West Mystic, Conn., the builders. This boat, the largest and most powerful of Uncle Sam's fleet of life saving craft, was built from designs of Capt. C. H. McLellan, R. C. S. (retired), of New York City, and contains many exceptional and remarkable features. Capt. McLellan has given much thought and attention to equipping the life service boats with power, and has in the "Audacious" produced a boat greatly improved over anything now in the service.

This particular craft is 36 ft. long by 8 ft. 6 in. beam and measures 8 ft. from the top of the bit head to the bottom of the keel. She is planked throughout with mahogany in two thicknesses, laid diagonal to each other with a thickness of canvas stretched in between. The model is the double end type with watertight houses at bow and stern. The after house contains the engine, hat was built especially for this service by the Holmes Co., and it contains many noteworthy features.

The engine is required to go in a very limited space, and for this reason it was necessary to devise a machine of the greatest possible power within certain limitations, and it can be safely said this machine, for its power, is the most compact six-cylinder gasoline engine ever built. It is "get-at-able" to every part, and operates on the long stroke plan, same as all other machines built by this company, the idea being to produce the highest efficiency with the least wear and tear on all parts. The diameter of the cylinder is 4¼ in., while the stroke is 6¼ in. The crank shaft has a bearing between each throw, making seven in all that are 2⅛ in. in diameter, while the crank pins are 2¼ in. diameter, or more than one-half the diameter of the cylinder, which is exceptional and far in excess of any other machine built, thereby insuring long life and great durability with the minimum amount of attention. The cam shaft is made from one solid piece of steel and is supported in four long babbited bearings. The faces of the cams are 11/16 in. and they operate

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ROBERT DOWNEY & CO., OSWEGO, N. Y.

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ERICK ERICKSON, RACINE, WIS.

Sch.	J. A. Holmes	E. Erickson	

CAPT. JAMES ERICKSON, MILWAUKEE, WIS.

Sch.	Quickstep	James Erickson	
"	Lake Forest	Christ Nerdrum	

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FRONTIER STEAMSHIP CO., WM. M. MILLS, MGR., N. TONAWANDA, N. Y.

Str.	Josiah G. Munro	C. E. Sayre	C. H. Menmuir

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Str.	Mary H.	J. E. Hess	George Moore

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Sch.	Monguagon	H. H. Pope	

LAKE ONTARIO & BAY OF QUINTE STEAMBOAT CO., KINGSTON, ONT.

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"	Caspian	William Bloomfield	D. J. Leslie
"	Aletha	John A. Roys	D. McSorley

upon independent adjustable lifters that are guided in the cam shaft bracket that forms a lengthwise brace to the whole machine. This cam shaft, which is hardened and bearings ground, can with the bracket and lifters be removed independently of the rest of the machine.

The cylinders, which are cast in pairs, three in all, are mounted on bronze A frames, being supported about midway of the length of the bore. This construction permits of the engine being open and accessible to each and every individual part. The pistons are so arranged they can be taken out inside of two minutes each. The crank boxes are of the highest grade bronze, main bearings of pure babbit. The connecting rods are drop forged of I beam section. The piston pin is 1¼ in. diameter, turns in the ends and is clamped to the connecting rod in the center, thereby giving greater wearing surface.

The oiling system is by a mechanical forced feed system of the McCord type with a separate feed to each main bearing and cylinder and requires no attention whatever after setting, only to keep the reservoir full of oil.

The fly wheel is on the after end with a clutch bolted into a part of same. The thrust bearing is back of this and is a specially designed combination thrust and coupling because of the very limited space in which it has to go. Bronze split rings are used for the thrust instead of ball bearings. This is done, so as to be able to take out the rings and renew them in case of wear, without being obliged to take out the shaft.

The exhaust header is another of this machine's remarkable features, and is a contrivance, whereby the piping has been done away with, the inlet and exhaust all contained within one casting that is entirely water jacketed and has a passage of water leading direct from the pump passing through between the inlet gas and exhaust gas, thereby insuring uniformity of running under varying atmospheric conditions, and at the same time reducing the heat from the exhaust. The water passes first through this header and then into each pair of cylinders directly around the exhaust valves, coming out at the top in about the usual way and from here is led into the water jacketed exhaust pipe, which leads first up from the engine and then turns and goes down and through the side of the boat in such a manner as to avoid any possibility of water coming back into

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"	Joseph G. Butler Jr.	James Murphy	Walter G. Thorn
"	John Stanton	Charles H. Heaton	Anton Rud
"	William A. Paine	Emil Detlefs	John Clark
"	Martin Mullen	U. S. Cody	George Oldman
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Sch.	Abyssinia	T. K. Woodward	
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Str.	Annie Laura	D. O. Lockhart	Jerry Shampaign
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	LAKE SHORE STONE CO., MILWAUKEE, WIS.		
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"	Topeka	Charles D. Ross	Charles Noyes
	CAPT. J. B. LOZEN, M. O., NEW BALTIMORE, MICH.		
Str.	Charles A. Streit	William Dun	Malcolm Cameron
Bge.	J. Godfrey	Noah Forten	
"	J. B. Lozen	J. F. Lozen	
	JOHN MCMILLAN, BOWMANVILLE, ONT.		
Sch.	Oliver Mowat	William Peacock	
	S. C. MCLOUTH, MARINE CITY, MICH.		
Str.	Sydney C. McLouth	William Sharkey	Roman Shinskey
"	Maine	William Boot	Wallace Lockhart
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	M. B. MCMILLAN, 907 HAMMOND BLDG., DETROIT, MICH.		
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"	Admiral	William Jagenow	George Purvis
	P. H. MCMILLAN, MGR., DETROIT, MICH.		
Str.	Senator	W. K. Nesbitt	W. K. Bolton
"	Colonel	A. Ames	August Cobo
	R. O. & A. B. MACKAY, MGRS., HAMILTON, ONT.		
Str.	Neepawah	O. Patenaude	George Fryer
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"	Rosedale	J. L. Baxter	Alex Forbes
"	Strathcona	J. A. Irving	Sam Jones
"	Donnacona	J. W. Mawdesley	A. E. D. Mackay
"	Winona	Ben Garvey	J. L. Campbell
"	Glenellah	George Mackey	John Robertson
"	Dundee	Henry Zealand	J. D. Andrew
"	Dunelm	James Grant	James Nicol
"	Dundurn	Robert Cooney	John M. Morris
	MANISTIQUE, MARQUETTE & NORTHERN RAILWAY CO., MANISTIQUE, MICH.		
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	EDWARD MEHL, M. O., ERIE, PA.		
Str.	Uganda	D. A. Kendall	Charles Nerreter
"	Wainwright	D. Elliott	A. W. Turner
	MUSKEGON STEAM BARGE CO., MUSKEGON, MICH.		
Str.	S. M. Stephenson	James Sanford	A. A. Green

the engine under any of the varying conditions to which this type of boat is exposed.

The sparking system is of the primary type jump spark with six separate coils. The current is generated by a dynamo driven from off the front end of the machine and is stored up in storage batteries that also furnish lights for the compartment and gage glass on the gasoline tank forward.

A compressed air whistle is placed on the bulk head and is operated from a large tank in the hold, that is stored up from the compression taken from one of the cylinders.

The controls of this machine are all on the outside of the bulk head, also the starting crank for the engine. This crank is connected by a chain to a ratchet sprocket starting attachment on the front end of the crank shaft, so devised that when the engine is in operation, the pawl is silent, but will engage the ratchet at any position on the turn.

The gasoline is stored in a large copper tank in the hold forward and from here is pumped by hand into a smallen 25-gallon tank in the forward house; from where the gasoline is led down through the bottom of boat and along keel outside and up into the carburetor in engine room, and does not pass through the cockpit of boat at all. This piping system is so arranged and vented that when the boat capsizes, both the vent and the feed to the carburetor will close at the same time and open immediately the boat rights again.

Splash plates are used to close in around the base of the engine and prevent oil flying out. The shipper handle for clutch is located on the bulk head in a recessed box, and like all the other bulk head apparatus, is arranged so as not to project beyond the face of the bulk head.

The engine will usually start on the switch without cranking. In one instance a machine had stood for seven days, after which it was started by simply throwing in the switch. When cranking is required, only a few turns are usually necessary.

The valves are all accessible through bronze caps in the valve chest, the spark plugs being in the center of each inlet valve cap. The cylinder heads are integral with the casting, thereby doing away with all possibility of water leaks. The jacket on three sides is covered with plates so as to be accessible for cleaning out.

This engine turns at about 700 R. P. M. and drives the boat 10 miles per

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hour. There is no vibration from the running of the engine and scarcely any noise from the water jacketed exhaust. The flexibility of operation is a very noticeable feature.

All the fittings on the bulk head after house, including the door, are made water tight so that in case of capsizing, the water will be kept out from around the machinery.

In the capsize test, made at the yard of the Holmes Co., the boat was hoisted over on to her beam ends and allowed to capsize and was bailed out and free from water inside of one-half minute and the engine put in operation inside of five minutes so that the boat was running out in the river, The test could have been accomplished in a quicker time, if necessary.

The boat is constructed so as to be absolutely non-sinkable, is self bailing and in case of capsize, will immediately right herself. The hold below deck is divided into eight separate watertight compartments and these compartments are filled with copper tanks, numbering 112 in all. There are copper tanks, also on deck along the inside of the gunwhale. A bronze keel, weighing about 1,500 lbs., is bolted to the outside of the boat and is the means for self righting in case of capsize. This boat is fitted with two hollow spars with two lug sails and jib, also a bronze center board and 17 pairs of oars, so that she is provided with three methods of propulsion.

The rudder is operated by a quadrant steerer operated by a shaft and handle at the front end of the bulk head in close proximity to the control for engine, shipper handle for clutch and starting crank, also the whistle. She is finished bright above the water line with green bottom and white house tops. The bow and stern are raking and the sides forward have considerable flare so that the boat presents a very pleasing sight to the nautical eye.

One hundred and twenty separate patterns for fittings, aside from the engine were required for this boat. The "Audacious" is similar to a boat recently constructed for the Canadian government, that is now stationed at Banfield creek, at Vancouver Island, not far from Cape Flattery. This boat also is equipped with the same type of six-cylinder engine furnished by the Holmes Co.

TEST OF GRAPHITE ON BALL BEARINGS.

There have from time to time appeared articles in the various trade papers condemning the use of graphite as a lubricant for ball bearings. The reason these articles have appeared, we presume, is because some users have had unpleasant experiences with inferior grades of graphite. Prof. Goss has made some extensive tests with Dixon's Ticonderoga Flake Graphite as a lubricant for ball bearingh combined with kerosene oil, lard oil and vaseline, and found that friction losses were very much reduced and the bearings made to carry a heavier load when Dixon's Ticonderoga Flake Graphite was used. The following are extracts from Prof. Goss' report:

The general appearance of the machine used in making the test is shown by Fig. 1, and the test ball bearing is shown at B. It has the form of a grooved ball-thrust bearing and was made by the Standard Roller Bearing Co., of Philadelphia, Pa. It consists of two hardened steel rings, each having a groove or race to receive the balls. The bearing fits a 1⅝ in. shaft and contains 23 7/16 in. balls. The lower race is caused to revolve through the action of the machine, while the upper one is fixed in position. The entire bearing is closed in the cup D. The cup is held in place by the wire H which serves to oppose its tendency to turn, and also to receive the tensional stresses due to the normal loading of the bearing.

The lower race B rests upon the

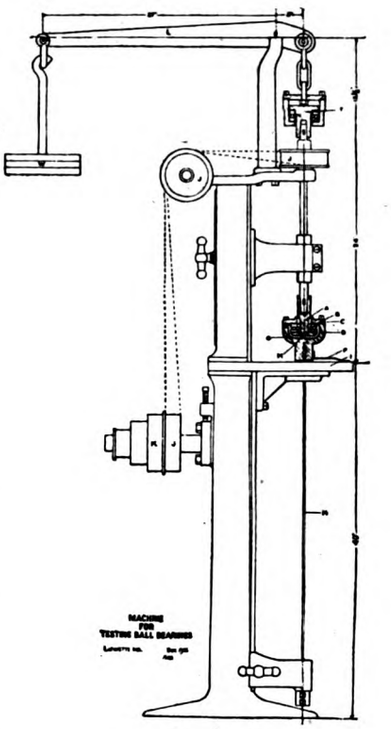

FIG. 1.

casting A which is attached to the spindle of the machine. By means of the cone pulley K and the pulley JJJ the spindle may be driven at three different speeds. The pressure imposed upon the balls is regulated by means of weights applied to the lever arm L, which is of such length that each 10 lbs. applied to the weight-pan W gives a reaction of 90 lbs. along

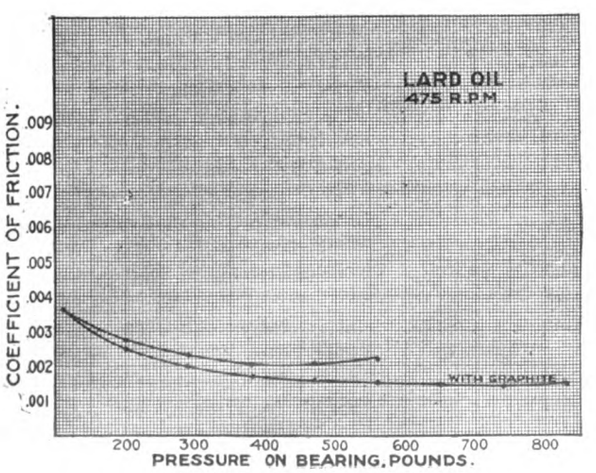

FIG. 2.

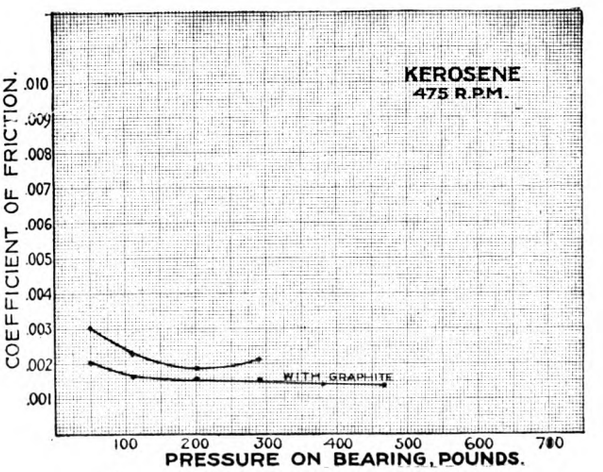

FIG. 3.

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the line of the spindle through the bearing T, and thence to the test ball bearing. The bearing T is similar in all respects to the test bearing, except that it is of greater capacity.

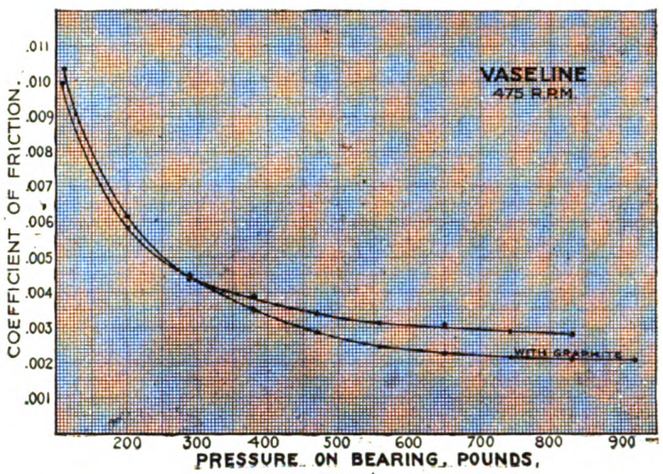

FIG. 4.

It has been shown by previous experimentation that graphite can be efficiently applied as a lubricant when mixed in small quantities with oil or grease. Following this practice, six series of tests were run; the lubricant employed upon the test ball bearing being, respectively, kerosene, a mixture by weight of 96 per cent kerosene and 4 per cent graphite; lard oil, a mixture by weight of 96 per cent lard oil and 4 per cent graphite; vaseline, a mixture by weight of 96 per cent and 4 per cent graphite; the graphite in all cases was Dixon's Ticonderoga Flake Graphite. Figs. 2, 3 and 4 show graphically the results obtained. Where the curves are not labelled, the results are without graphite.

As the result of these tests Prof. Goss says in part that the following general conclusions may be drawn:

"A combination of graphite and lard oil makes up a lubricating mixture which, when applied to ball bearings, will accomplish everything which lard oil alone will do and which at the same time will give a lower frictional resistance of the bearing and permit a large increase in the load which it may be made to carry.

"An oil as light as kerosene, when intermixed with graphite, will be converted into an effective lubricant for ball bearings when operated under light or medium heavy pressure.

"Even so viscous a lubricant as vaseline will better perform a given service in the lubrication of ball bearings when supplemented by small amounts of graphite. The bearing to which the mixture is applied will work with less frictional resistance and will carry a heavier load than when vaseline alone is used.

"The admixture of graphite with either a liquid or a viscous lubricant serves both to reduce the friction and to increase the possible load which a bearing thus lubricated can be made to carry."

SCHERZER ROLLING LIFT BRIDGES.

The tendency in railroad development during the last few years both in the United States and abroad has been the concentration of traffic on existing rights of way by means of multiple track construction rather than through adjacent competing lines, extra trackage at the present time in the United States amounting to about 20 per cent of the total mileage in this country. On many of our prominent railroads particularly those through the more thickly populated districts traffic has increased so rapidly during the past 10 years as to require two, four and six parallel tracks for its accommodation and economic handling. This increase in trackage will become common in a greater or lesser degree to every railroad as its territory is developed and the natural increase in traffic results. In the light of experience during the prosperous conditions of the past few years it would seem safe to predict that present railroad traffic will be doubled in the next 10 years and that this ratio of increase will continue for decades to come.

One of the most important features in the matter of handling a rapidly increasing traffic and the construction of necessary additional parallel tracks is the requirement for the accommodation of shipping at the crossings of navigable waterways. An inherent limitation of the old-fashioned type of center-pier swing bridge for railroad traffic is the fact that it cannot be enlarged or widened to accommodate additional tracks. This necessitates its being discarded and removed at great loss both in the cost of the new bridge and the accompanying derangement of traffic. It is self-evident that if a new swing bridge were constructed alongside of an existing swing bridge without a material increase in the right of way and a very wide spreading of tracks it would be impossible to operate either bridge because of interference. This difficulty is overcome by the modern type of bascule bridge which can be constructed as a single-track structure and be enlarged to a double or multiple track bridge at any time without interfering with the existing bridge or disturbing traffic, by simply adding new bridges alongside of the structure then in use. These additional single or double-track bridges can be operated as separate units or linked with the existing bridge and operated as one structure as desired.

Among the bridges designed by the Scherzer Rolling Lift Bridge Co., Chicago, and now in operation or under construction both in this country and abroad, are many of the longest span and widest movable bridges ever constructed, nearly all of these structures having superseded and replaced center-pier swing bridges in the movement for additional parallel tracks to accommodate increased traffic. Some of the more notable Scherzer rolling lift bridges are the four-track bridge for the Metropolitan West Side Elevated railroad, Chicago; the double-track bridge for the Chicago Terminal Transfer railroad at the entrance to the Grand Central station, Chicago; the eight-track bridge at Chicago used by the Pennsylvania lines, Chicago Terminal Transfer, Chicago Junction and Baltimore & Ohio railroads; the single-track bridge for the Big Four route at Cleveland; the doubletrack bridge used by the Big Four, Lake Shore & Michigan Southern and Erie railroads at Cleveland; the duplicate adjacent double-track bridges used by the Newburg & South Shore and Baltimore & Ohio Railroad companies at Cleveland; the very long span single-track bridge for the Baltimore & Ohio railroad at Cleveland; a double-track bridge at Cleveland for the New York, Chicago & St. Louis railroad; two bridges used for the Central Railroad of New Jersey, the Reading and the Baltimore & Ohio railroads across Newark bay; a double-track bridge for the Boston, Revere Beach & Lynn railroad near Boston and the six-track bridge at the entrance to the South Terminal station, Boston, for the New York, New Haven & Hartford railroad. The New Haven railroad also has Scherzer rolling lift

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bridges in service at Neponset, Mass.; Bridgeport, Cos Cob and Westport, Conn.; and across the Housatonic, Niantic and Connecticut rivers, Conn. A number of additional bridges of the Scherzer type are under construction for the New Haven road at different important crossings, among them being a double-track bridge across the Seekonk river at Providence and six-track bridges across the Bronx river and Eastchester bay on the Harlem river branch of their New York division. The New York Central lines have under construction a double-track Scherzer rolling lift bridge across Wappinger creek on the eastern division. This bridge is expected to be placed in service in the near future. Double-track Scherzer rolling lift bridges for the Lake Shore & Michigan Southern and Chicago, Lake Shore & Eastern railways at Indiana Harbor are under construction and will be ready for service upon the opening of the East Chicago canal which they cross. The Norfolk & Western railway has two double-track Scherzer rolling lift bridges under construction across the southern and eastern branches of the Elizabeth river near Norfolk and a single-track bridge is under construction for the Seaboard Air line across Hillsboro bay, Tampa, as a part of the new terminal improvements being made by the Seaboard Air line at that point. Two single-track bridges of the Scherzer type are under construction for the Norfolk & Southern railway across Albemarle sound as the movable spans in a long trestle the Norfolk & Southern road has under construction to replace the present ferry service between Edonton and Mackay's ferry. The double-track Scherzer rolling lift bridge crossing Coney Island creek for the Brooklyn Rapid Transit System has been in service for several months, carrying the heavy traffic on that line. The erection of the single-track Scherzer rolling lift bridge crossing Rainy river for the Duluth, Rainy Lake & Winnipeg and Canadian Northern railroads is now being carried on and it is expected to place the bridge in service within 30 days. Work is also being pushed on the long span double-track bridge for the San Pedro, Los Angeles & Salt Lake railroad now under construction across the San Gabriel river at Long Beach, Cal.

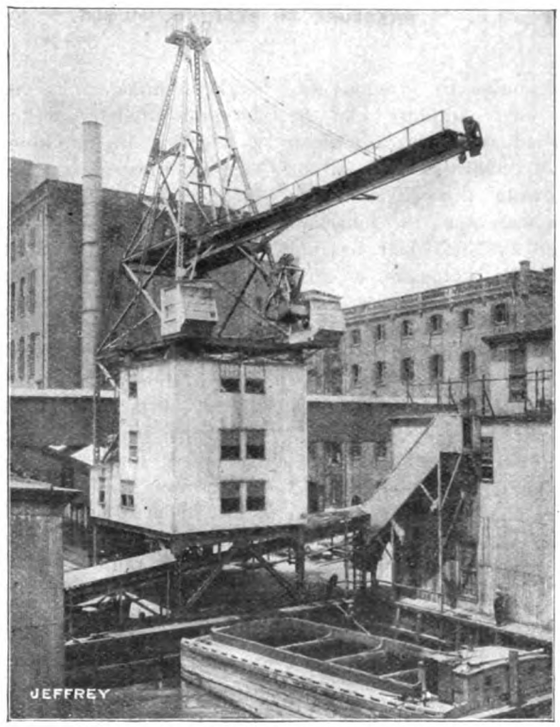
Several bridges of the Scherzer type designed for foreign railroad service are now in active use, among them being a double-track bridge for the Southeastern & Chatham railway across the Swale river, England; a double-track bridge for the Fishguard & Rosslare Railways & Harbors Co. across the Suir river, Ireland, and three single-track bridges for the Dutch Railroad Co., Holland. A number of Scherzer rolling lift bridges are also under construction for both British and Colonial railway service. It is expected that the combination single-track railway and highway bridge at Barrow-in-Furness, England, and the two double-track bridges for the Buenos Ayres Great Southern railway at Buenos Ayres, Argentina, will soon be placed in service and work is now being pushed on the long span bridge for the Burma railways near Rangoon, India. Several bridges of the Scherzer type are in operation or under construction in Egypt and the two railroad and highway bridges for the Tehuantepec Railway Co. at Salina Cruz, Mexico, will be completed in the near future.

About 50 Scherzer rolling lift bridges have already been constructed for the use of electric street railway and interurban service, these bridges having nearly all been constructed as double and multiple track structures. They can readily be enlarged for additional tracks at any future time to accommodate increased traffic without disturbing either the existing bridge or the traffic over the structure.

UNLOADING OF FUEL BARGES

The problem of supplying to the large boiler houses which have been erected in the east has received a great deal of attention and study during the past few years, and several types of machines have been built for the rapid unloading of fuel barges. The type which is obtaining the greatest success in the eastern part of the country is the two-man steeple with horizontal boom. These towers have been made both of steel and timber construction, some of a combination frame with timber struts and fitted with steel booms. Almost all manufacturers have adopted the one type of hoisting engine employed for use on steeple towers.

One of the examples of recent installation of this character is the steel tower erected at the plant of the Spreckels Sugar Refining Co., at Philadelphia, Pa. This tower is shown in the accompanying view, which brings out the rather heavy style of construction. This equipment is designed to unload barges which come in a rather narrow slip, and which lie head on to the unloading tower. The coal is elevated, crushed, screened, weighed and delivered to the belt conveyer, which carries it to the boiler plant, located some 300 ft. away. This work requires the services of two men on the tower and one and part of the time, two men in the barge to help clean up and guide the bucket during the last part of the unloading.



JEFFREY GRAB BUCKET HOISTED.

The tower proper is an all-steel structure made up of lattice channel columns, with stiff bracing. The structure contains five distinct floors or levels in it, made up of heavy planks

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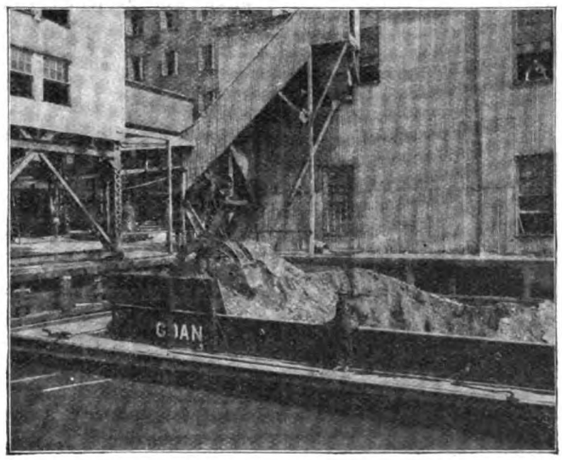
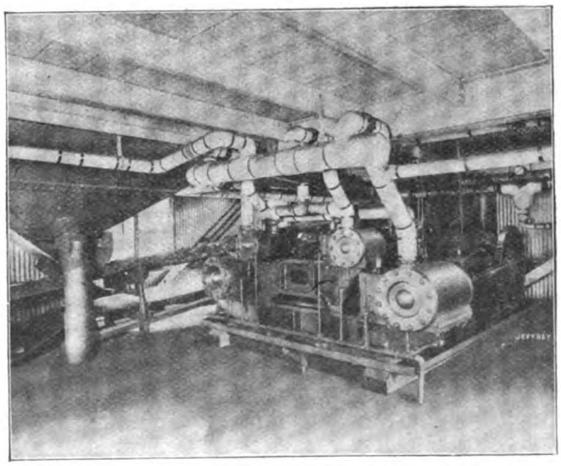
laid on steel floor beams. All floors have in addition to the heavy planks a wearing surface made of 1-in. hard wood flooring laid diagonally. The



JEFFREY GRAB BUCKET FILLING.

first or lower floor contains the hoisting engine, and the engine for driving the crusher; the second floor contains automatic scales; the third floor a four roll crusher; the fourth floor receiving hopper; the fifth floor is at the level of the boom which supports the trolley, and there is in addition a crows-nest around the head sheave which allows easy access for the inspection of the bearings located at this point. All the floors which are outside of the house proper are well provided with hand railings. The



JEFFREY RUBBER BELT CONVEYER CARRYING COAL IN POWER HOUSE.

cabs protecting the operators are two in number located at opposite sides of the tower.

In one cab is placed the bucket man who controls the hoisting, lowering, opening and closing of bucket, in the other the trolley man who controls the motion of the trolley along the boom. These cabs are very well provided with windows, in fact three sides are all of glass. The covering used is heavy galvanized corrugated sheet made of rero'led iron.

Extending from the lower engine floor to the fourth or hopper floor is a housing made of heavy corrugated galvanized iron sheet. The hoisting machinery used to handle the bucket and trolley consists of one Lidgerwood Steeple Standard hoisting engine fitted with two cylinders 15 x 24-in. direct connected to 30-in. drums equipped with 54-in. double cone friction automatic brakes. The trolley engines consist of a pair of 10 x 12-in. engines direct connetced to a 16-in. drum fitted with cone friction and band brakes. The other machinery in the tower is driven by a double cylinder single acting Westinghouse engine.

The arrangement of levers for controlling the hoisting engines is very simple, and each operator has but three to handle, one for each hand, and one for his foot; the foot lever in each case controlling the throttle on the engine. The bucket with which this tower is equipped is the second of its type which has been placed in service along the eastern coast, but still is only one of a number of the large group which are working successfully in handling sand, gravel, broken stones, coal and other materials at different points throughout the interior states of the country and along the Pacific slope. It differs in many points from the ordinary clam shells and will handle successfully materials which the clam shells can not penetrate. In this particular instance equipment will have to handle large lump coal more than half the time and in order to obtain the desired capacity, the bucket must be able to handle the large coal as rapidly as the small. The equipment is designed for continuous capacity of 120 tons per hour from barge to receiving hopper. The hoist from barge at mean tide water to the hopper is about 60 ft. and the length of travel is 57 ft.

In the hands of expert runners with this height of hoist and travel, coal can be unloaded at the rate of 200 tons per hour. The entire equipment was designed and built by the Jeffrey Mfg. Co., Columbus, Ohio, with the exception of the parts previously noted.

YARROW GUNBOAT.

The Portuguese government has placed a contract with Messrs. Yarrow & Co., Ltd., of Glasgow, (formerly of Poplar, London,) for the construction of one of their very shallow-draught gunboats for Macao. This vessel will be 120 ft. in length by 20 ft. beam, and will draw, loaded with 25 tons, 25 in. The guaranteed speed is 12½ statute miles an hour. The vessel will be armed with suitable artillery, and the various stations where the officers and men will stand will be bullet-proof. The propelling system will be by means of a Yarrow watertube boiler and engines driving two screws working in tunnels fitted with Yarrow's patent hinged flap aft. The vessel will be completely put together at Messrs. Yarrow's new works on the banks of the Clyde. She will be shipped in pieces, re-erected, riveted together and launched in China.

The steamer Fred G. Hartwell, building for the Mutual Steamship Co. at the yard of the Toledo Ship Building Co., Toledo, will be launched April 4.

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LARGE PUNCH BUILT BY WILLIAMS, WHITE & CO.

Williams, White & Co., Moline, Ill., have just completed building for the Standard Oil Co. a gigantic punch,

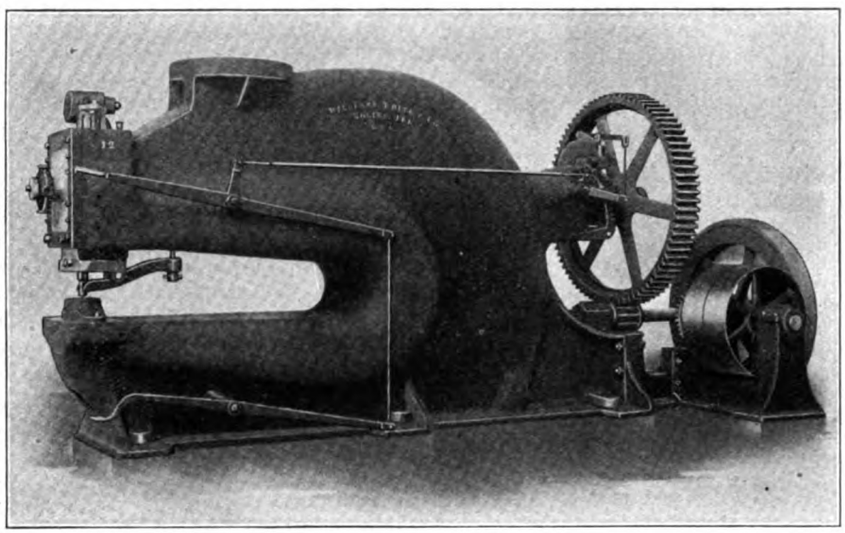

FIG. 1—SIDE VIEW OF LARGE PUNCH BUILT BY WILLIAMS, WHITE & CO.

front and side views of which are shown in the accompanying illustrations. The machine weighs 63,000 lbs. and is intended for punching heavy plates, having a capacity to punch holes up to 2 inches in 1⅛ in. plate. The punch has a massive appearance enhanced by the use of a cored section rather than girder frame. The throat is cut deep to permit the handling of large plates, the distance from the center of the punch to the back of the throat being 66 in. The punch is operated by a right angle direct-motor drive with spur gear and pinion and is equipped with an adjustable automatic stop clutch.

A YEAR'S SUEZ CANAL TRAFFIC.

The following is a comparative statement of the traffic of the Suez canal for the years 1905, 1906 and 1907. The total movement of ships was 4,267 vessels of 20,551,982 tons gross, compared with 3,975 vessels of 18,810,703 tons in 1906, and 4,116 vesses of 18,310,442 tons in 1905. Of the total tonnage last year, 2,651 vessels of 13,107,343 gross tons were British, against 2,333 vessels of 11,493,279 tons in 1906, and 2,484 vessels of 11,507,794 in 1905. The dues received in 1907 amounted to 112,749,925 francs, compared with 103,709,441 francs in 1906 and 110,658,352 francs in 1905, the total receipts being over 4,000,000 francs in excess of these figures in each year. The following shows the percentage of the respective flags (based on the gross tonnage) which passed through the canal in 1907: British, 63.78 per cent; German, 15.53; French, 5.89; Dutch, 4.33; Austrian, 2.98; Japanese, 1.79; Russian, 1.58; Italian, 1.44; Danish, 0.68; Turkish, 0.52; Spanish, 0.51; Norwegian, 0.36; Greek, 0.29; Swedish, 0.16; American, 0.10; Belgian, 0.04, and Chinese, Egyptian, Portuguese and Siamese, 0.02 each.

WILL BE KNOWN AS A JONES STOKER FIRED VESSEL.

When the James E. Davidson leaves her winter quarters at Superior, Wis., at the opening of navigation to enter upon her season's run between Duluth and Lake Erie ports, she will be classed as a Jones stoker fired vessel; the installation of six Jones stokers under the Niclausse water tube boilers in her firehold now being practically completed by the manufacturers, the Under-Feed Stoker Co. of America, Chicago. No doubt the performance of the Davidson will be closely watched by marine men during the coming season on account of the interest created in this system of boiler firing by the Jones stoker installations aboard the Eugene Zimmerman on the great lakes and the Ossabaw on the Atantic. According to late information at hand the Zimmerman showed a most pronounced saving last season in expense for fuel as compared with a boat of two-thirds her size and carrying capacity, whose boilers were fired by hand.

The steamer A. E. Nettleton, building for H. S. Wilkinson, of Syracuse, will be launched from the Wyandotte yard of the American Ship Building Co. early in April.

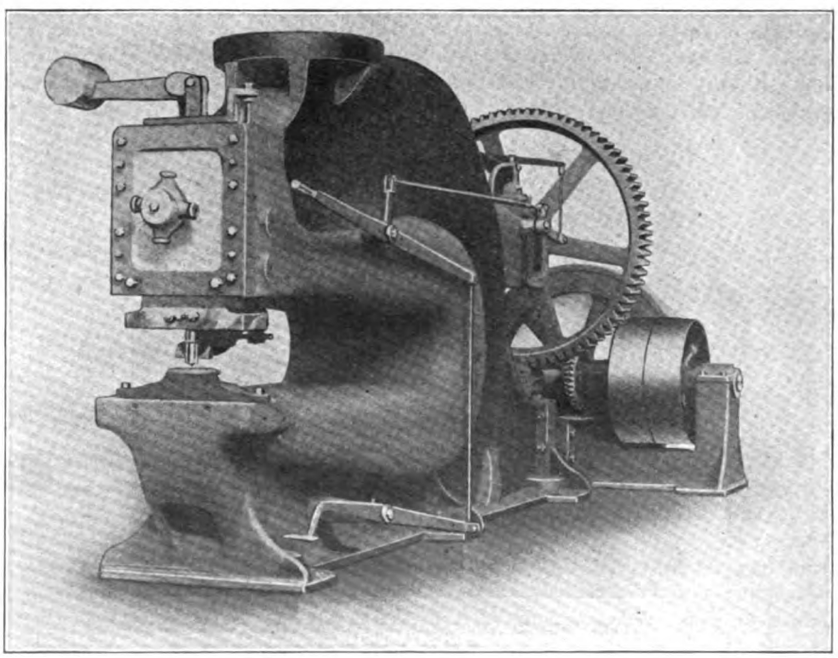

FIG. 2—FRONT OF LARGE PUNCH BUILT BY WILLIAMS, WHITE & CO.

The navy department has received word that the old warship Monongahela was burned to the water's edge at her station in Guantanamo bay.

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Our reputation as Outfitters of Vessels has grown year by year.

REACTIONS

¶ That is the title of a quarterly periodical which will be issued regularly by us from now on. It is devoted to the science of Aluminothermics and will be sent free of charge to anybody in the United States, Canada, Mexico or Cuba, who may be interested in the Thermit Process for Welding Broken Sternposts, Rudder Frames, Crank Shafts and other Steel Sections, Reviving or Purifying Molten Iron in the Ladle, butt-welding pipes and the various other applications of the process.

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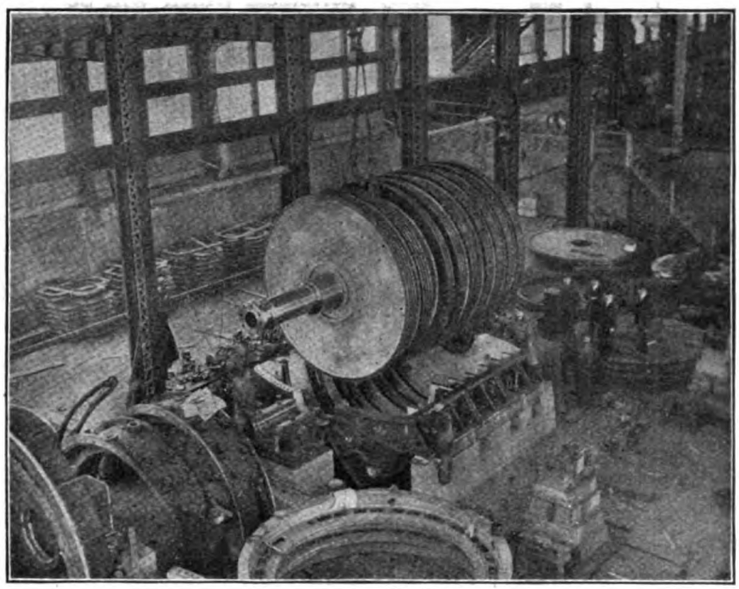
TURBINE FOR JAPANESE CRUISER.

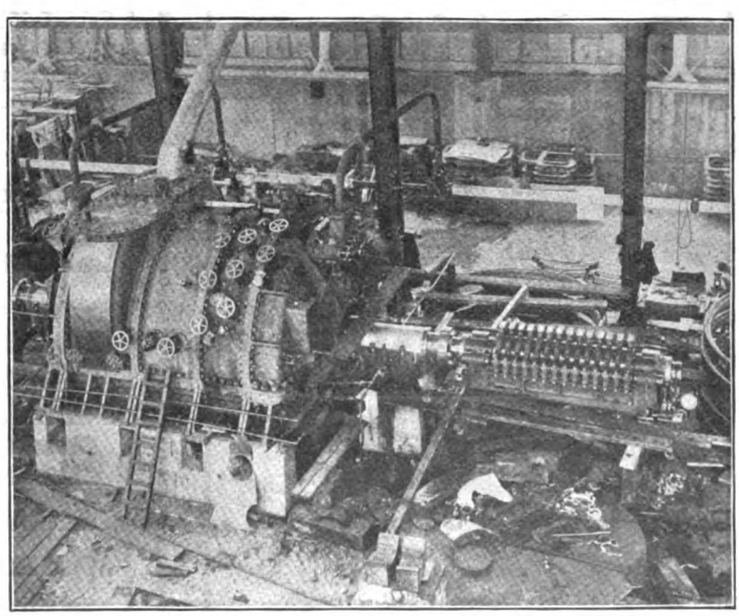
Herewith is published a photograph of a rotor being lifted from lower casing for one of the two 144-in. seven-stage Curtis marine reversible steam turbines which are to be installed in a Japanese armored cruiser of 23-knot speed. Each turbine will develop a brake horsepower of 12,000 with considerable overload capacity. This pair of turbines will be shipped during the present month by steamer via the Suez canal to Kure, Japan. The two Japanese officers shown in the photograph are on the left, Lieut. S. Yoshida, senior inspector imperial Japanese navy, and on the right, Lieut. Constructor Y. Kamimura. The other photograph shows the turbine in process of construction.



LIFTING ROTOR OF JAPANESE ARMORED CRUISER FROM LOWER CASING.

TUG FOR MUTUAL TRANSPORTATION CO.

The Greenock & Grangemouth Dock Yard Co., Ltd., successfully launched from their Grangemouth yard this month the single screw tug Stirling which they have built to the order of the Montreal Transportation Co., Ltd., of Montreal, Canada, to designs and specifications by the company's naval architects, Messrs. John Reid & Co., of Glasgow, London and New York. The vessel, which is one of the most powerful and up-to-date of her kind afloat, is intended for service on the St. Lawrence river and Canadian great lakes. She is fitted with special auxiliary machinery in the engine room and on deck for the easy handling of the tow lines, and can also be used as a salvage steamer. Her dimensions are: Length between perpendiculars, 125 ft.; breadth molded, 25 ft.; and depth molded, 14 ft., built in excess of Lloyds highest class with a full equipment, powerful steam windlass, steam capstan, steam steering gear and electric light throughout. Accommodation is provided for officers and crew in keeping with the company's usual standard. The machinery is being supplied by Messrs. Muir & Houston, Kinning Park, Glasgow, and consists of a set of triple-expansion engines and a large boiler fitted with Howden's forced draft for a speed of 13 knots in working conditions. As the vessel left the ways she was gracefully named by Mrs. Dunlop, wife of John Dunlop, of Glasgow. After the launch the company adjourned to the builder's model room where the usual toasts were proposed and responded to, and cake and wine was partaken of.



TURBINES FOR JAPANESE ARMORED CRUISER IN COURSE OF CONSTRUCTION.

R. P. Schwerin, vice president and general manager, Pacific Mail Steamship Co., in discussing the Ocean Mail Act now before congress, said that he feared that the appropriation would be almost entirely consumed in the added cost of substituting Americans for Asiatics. He calculated that the annual wages of the Asiatic crews on the five vessels is $276,924 and the food bill $90,392. The substitution of white crews would increase the wage scale to $547,611 and the cost of food to $316,218.

The Graham & Morton Transportation Co. will make their first sailing of passenger steamers on April 1, with daily trips on both divisions of their line.

The steamship Pomona belonging to the fleet of the Pacific Coast Steamship Co., was wrecked on Montery reef, March 17. Passengers and crew were all saved. The Pomona was built by the Union Iron Works in 1888 and is 225 ft. over all, 33 ft. beam and 16 ft. deep.

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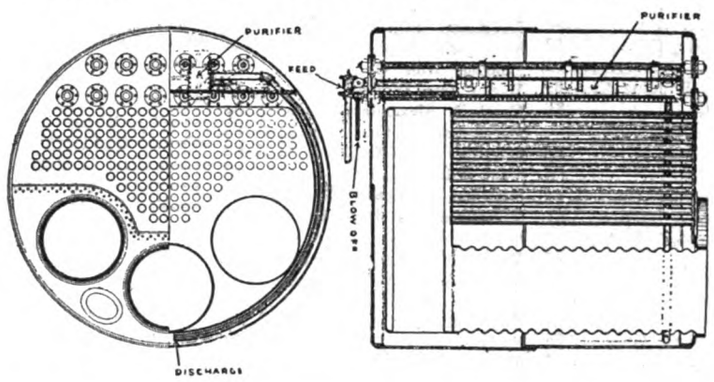

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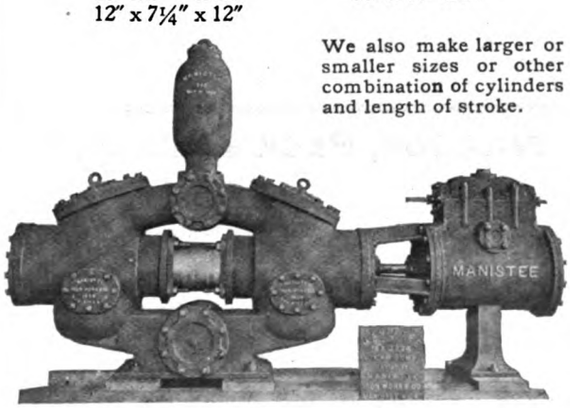

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U. S. Engineer Office, Milwaukee, Wis., March 20, 1908. Sealed proposals for building pile pier, removing old pier, and dredging at Waukegan Harbor, Ill., will be received here until 2 p. m., April 20, 1908, and then publicly opened. Information furnished on application. W. V. Judson, Major Engrs.

U. S. Engineer Office, Duluth, Minn., March 6, 1908. Sealed proposals for dredging and hire of dredging plant at Superior Entry, Wis., will be received here until noon Monday, April 6, 1908, and then publicly opened. Information on application. Graham D. Fitch, Major, Engrs.

U. S. Engineer Office, Jones building, Detroit, Mich., March 17, 1908. Sealed proposals for dredging Hay Lake and Neebish Channels, St. Mary's River, Mich., will be received at this office until 3 p. m. April 17, 1908. Information furnished on application. C. McD. Townsend, Lt. Col. Engrs.

U. S. Engineer Office, Duluth, Minn., March 10, 1908. Sealed proposals for furnishing steel plate at Superior, Wis., will be received here until noon, April 9, 1908, and then publicly opened. Information on application. Graham D. Fitch, Major Engrs.

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